



INDIAN AGRICULTURAL
RESEARCH INSTITUTE, NEW DELHI.

A. R. I. 6.

HPV-81-MAR/57 3458 5,000.

सत्यमेव जयते

Report of the Council

OF THE

Zoo-logical Society of New South Wales

FOR THE

YEAR ENDED DECEMBER 31st, 1915.

Annual General Meeting of the Society, which was held on February 11th, 1915, at the Royal Ball, Sydney, the following retiring Members of the Council were re-elected :—Dr. Sydney Jamieson, Mr. Allan R. McCulloch, Mr. J. M. Smail, Dr. R. H. Todd, and Mr. G. A.

At a recent special meeting of the Council the following Office-bearers were elected :—President, Jamieson; Vice-Presidents, Charles Hedley, A. F. Basset Hull, Albert E. Nash, Dr. R. H. Todd, J. Green.

Number of Members of the Council at meetings during 1915. Meetings held :—11 ordinary. Major J. S. Brunton, 6; Dr. Sydney Dodd, 8; Mr. H. E. Finckh, 10; Mr. W. W. Mr. W. J. Green, 12; Mr. Chas. Hedley, 6; Mr. A. F. Basset Hull, 12; Dr. Sydney (service, granted leave), 3; Mr. A. E. Jaques, 5; Mr. T. W. Keele, 8; Mr. Allan Albert E. Nash, 4; Mr. W. J. Rainbow, 9; Mr. J. M. Smail, 5; Colonel A. Spain, 18, 8; Dr. R. H. Todd, 3; Mr. G. A. Waterhouse, 9; *Government Representatives* : Messrs, M.L.C.; The Hon. H. C. Hoyle, M.L.A. *City Council Representatives* : Alderman J. H. Laurence.

ATTENDANCES.

Visitors to the Gardens during the year under review was as follows :—

Days, Adults.....	53,460
" Children.....	28,792
Week Days, Adults.....	85,426
" Children.....	41,414
Schools.....	986
Naval and Military.....	1,052
	211,130

A decrease of 20,530 as compared with the attendance during 1914. The very adverse conditions by the war were largely responsible for the decrease.

ANIMALS.

Work has been kept well up to standard, many interesting specimens being added. With the aid from the Government, the Society was enabled to obtain a splendid collection of other animals from Africa, many of which are extremely rare and have not been introduced into Australia. These include Blessbok, Lechee, Impala, Bushbok, Springbok, Kudu, Antelope. One Brown Hyæna, Black Mangabees, Squirrels, several species of Reptiles, 15, Hinged Tortoise, Stanley Cranes, Hornbills, Egyptian and Spur-wing Geese, 20—the latter are very brilliantly coloured birds and form one of the principal attractions of the large Flight Aviary.

ROYAL ZOOLOGICAL SOCIETY

Dangar presented a fine herd of Indian Antelope, intended for exhibition purposes, it is intended to deposit in State Institutions.

Among the births during the year, that of a Chacma Baboon, born in the Gardens, is the most interesting, and the animal should prove a great attraction placed on exhibition.

The following is a list of animals and birds born and reared in the Gardens during the year:

1 Chacma Baboon	1 Antilopine Kangaroo
1 Barbary Sheep	1 Rat Kangaroo
1 Timor Deer	2 Golden Agouti
1 Fallow Deer	2 Bronzewing Pigeons
1 Hog Deer	2 Blood Breasted Pigeons
1 Woodward's Kangaroo	3 Spotted-sided Finches

336 specimens were presented to the Society, and the Council is much indebted to the donors. 76 were placed on deposit for various periods and 46 received in exchange; 423 sent in exchange, while 59 duplicate specimens were deposited in Taron Government Reserves; 2 specimens escaped and 3 were stolen. Several collections were exchanged. The value of the collection on December 31st was estimated at £4,400. A number of Magpies were sent to Fiji to assist the planters in combating the

GENERAL.

In view of the pending completion of Taronga Zoological Park and the other assets of the Society to the Park, it was considered necessary to make rules of the Society to formally legalise the transfer, and the following are sanctioned:—

The omission of Rule 2 and the insertion in lieu thereof of the following:

2. The objects of the Society shall be:—

(a) The advancement of Zoology by the exhibition of wild animals in a living state; by the introduction and acclimatization of species from abroad, and by the diffusion of useful knowledge in the animal kingdom.

(b) To hand over the whole or such animals or any number of the collection to the Taronga Zoological Park Trust, or to any corporation among its objects the exhibition of animals in a living state.

(c) To sell the property of the Society or any portion thereof, including aforesaid or any of them, to any person for such price as the Council of the Society may think fit; and to hand over all or any of the property of the Society, with or without the Taronga Zoological Park Trust, or any corporation or trust as aforesaid.

(d) To surrender any leases.

(e) To give or lend the whole or any portion of the Funds or other property to the said Taronga Zoological Park Trust, or any other corporation or Trust.

In consideration of this transfer of property, the Taronga Park Trustees have agreed to permit the members of the Society to retain the privileges they now possess at Moore Park, and the new Gardens, under the following agreement:—

In consideration of the transfer of the properties mentioned in the above, the Royal Zoological Society of New South Wales (hereinafter called the Society) and the Taronga Zoological Park (hereinafter called the Trustees) have agreed that the Society:—

SMITHSONIAN INSTITUTION.
UNITED STATES NATIONAL MUSEUM.

A LIST OF THE BEETLES OF THE
DISTRICT OF COLUMBIA.

BY

HENRY ULKE.

From the Proceedings of the United States National Museum, Vol. XXV, pages 1-57.

[No. 1275.]

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1902.

A LIST OF THE BEETLES OF THE DISTRICT OF COLUMBIA.

By HENRY ULKE.

I. INTRODUCTION.

The following list of the Coleoptera of the District of Columbia is the result of a diligent search extending over a period of nearly forty years.

In the fifties, the city of Washington was still surrounded by many fine woods and lovely meadows, which promised the entomologist and botanist a rich harvest. In truth, almost every collecting excursion in those days furnished abundant new material and raised the interest and enthusiasm of the collector to a high pitch.

With the beginning of our civil war, the woods on the Virginia side of the Potomac began to disappear, and not many years later the pleasant fields and woods north and northwest of the city were occupied by city extensions, avenues, and building lots, so that one hunting ground after the other was captured by advancing civilization.

Nevertheless the right bank of the Potomac, between the Aqueduct Bridge and Little Falls, remained a rich field for the collector until quite recently, when it, too, began to suffer from the inroads of the stone quarrymen and others.

As a result of the destruction of forests and meadows, a number of beetles seem to have disappeared, which were formerly quite common, such as *Borus unicolor*, *Doryphora juncta*, and *Laricobius erichsoni*, while other species were introduced with the extension of agriculture and horticulture. Among the introduced species, some have multiplied so fast that they may now fairly be considered pests, such as *Phytonomus punctatus* and *Sitones hispidulus*. A large portion of the District, however, still remains unexplored, and only recently the southeastern region, toward Marlboro, furnished botanists several species not previously enumerated in Lester F. Ward's excellent List of the Flora of Washington and Vicinity.

The northeastern region, in the neighborhood of Odenton, should also be studied more carefully, as, for example, the sand dunes there constitute the only places where the rare *Cremastochilus leucostictus* was found.

Notwithstanding the attendant difficulties and large extent of unexplored territory to furnish a nearly complete list of the Coleoptera of the District of Columbia, I must acknowledge that success is in part due to the encouragement of my friend, E. A. Schwarz, who kindly lent his wide experience and assistance in preparing the annexed biological notes.

The following important facts have been observed concerning the relation existing between the local geology, flora, and general fauna and the occurrence of the District beetles in special.

It is a well-known fact that the distribution and varied habits of Coleoptera afford such striking features that the general physical characteristics of any locality can be determined from an average collection of the beetles of such region.

The number of species found in the District of Columbia, or, more broadly, in an area within a radius of 20 miles of the Capitol, is not less than 3,000. This is a much larger number than has been recorded from local lists of any other equal area in the United States. It represents about one-fourth of the total number of species now recorded from North America north of the Mexican boundary.

Let us now examine the physical conditions which form the environment of the Coleoptera here.

The geology of the District presents the following features:

Washington City is chiefly built upon thin beds of sedimentary sands, clays, or gravels of the Post-Jurassic age, covering the Archean crystalline rocks—chiefly gneiss and granite.

Satisfactory exposures of these rocks are to be found only in the deep ravines cut by the Potomac and Rock Creek or their tributaries, since, at the surface of the Washington plateau, their character has been obscured or obliterated by extensive superficial decay and by cultivation.

Toward the west the gneisses, which are for the most part granitoid in character and possess a north-south strike, become somewhat more foliated and schistose. In many places it appears that the granites and gneisses have been subjected to extensive metamorphism. Near Georgetown and Cabin John occur pronounced developments of a massive dark-green diorite, and in other localities are found bands of siliceous and chloritic schists. These, however, grade imperceptibly into the prevailing granite and gneiss, and probably represent the result of intense dynamic action. Limited occurrences of gabbro, serpentine, and steatite complete the list of eruptive rocks found in the District. Altogether they contain at least forty different mineral species.

The soil formed by the decomposition of the above sediments and rocks is so varied in character that it is able to support no less than 1,400 species and varieties of vascular plants.

Now, as about half of all the beetles depend upon plants for their food, the greater the variety of food plants the larger we find the number of species of beetles.

The geographical position and topographical features of the District of Columbia also largely account for its diversified insect fauna.

The coastal plain deposits, concealing the crystalline rocks of the eastern and southern portions of the District, are formed into numerous terraces, so that Washington is surrounded by low hills on all sides, except where the Eastern Branch and southeastern shores of the Potomac flatten out into marshy grounds.

As the District lies on the border of the crystalline plateau and the lower coastal formation and at the head of tide water on the great lowland plain, which extends from New York to Richmond, the local fauna has the composite character belonging to the upper austral, lower austral, and the transition zones, or, to be more exact, it has the facies of the Allegheny, Carolina, and austro-riparian regions, as classified by Dr. C. Hart Merriam.¹

In a region so restricted and comparatively level, there are of course no such changes in the temperature as in mountainous countries, where we find forms of insects on the top of mountains very different from those below, the former being always of a more northern type. The appearance of northern and southern forms are here controlled by the change of seasons, so in early spring we may always expect more northern types, while in midsummer the southern ones predominate.

There are other local causes which influence the character of our fauna. The Potomac River every spring carries down quantities of flood debris from the mountain districts, containing insects which properly belong to higher elevations, for example, *Phalopsis obscurata*, *Pinodytes cryptophagoides*, *Corebura longula*, *Echodes sericea*, and several Carabidæ, Longicorns, and Elateridæ. Southern forms have been observed chiefly in the middle and eastern part of the District as along the Eastern Branch, where species were collected, such as *Chironia ludoviciana*, *Cymindis elegans*, *Thalpius dorsalis*, and several Chrysomelidæ.

The great attraction of the electric lights for insects has also resulted in the discovery of certain kinds, whose occurrence here was not previously known with certainty, such as *Omphron laticornis*, *Clivina punctigera*, *Platynus picticornis*, *Rhantus calidus*, *Atænius figurator*, *Pleurophorus ventralis*, and *Donacia hypoleuca*, which belong to the austroriparian fauna.

¹The geographical Distribution of Animals and Plants in North America. Bull. Nat. Geog. Soc., 1895.

To convey a correct impression of the geographical distribution of the beetles, it is absolutely essential to obtain accurate lists of the Coleoptera of the different sections of this country. The first step in this direction was taken by Messrs. E. A. Schwarz and H. G. Hubbard, who prepared the Coleoptera of Michigan and Florida, and their example was followed by numerous other entomologists. Of special interest for comparison is Dr. John Hamilton's Catalogue of the Coleoptera of Southwestern Pennsylvania (1895).

There are especially three localities in the immediate vicinity of Washington which have been very carefully explored by the entomologists: The meadows, rocks, and woods along both sides of the Potomac and including the river flats across Long Bridge; the valleys of the Rock Creek, and the banks of Eastern Branch. The richest collecting ground near Washington has been the rocky ledges and ravines along the south banks of the Potomac just above the Free Bridge. The Rock Creek region is also full of interest. The creek cutting its snake like course here through solid rocks, leaves deep ravines and winds its way among mossy sand banks and swampy meadows, presenting a variety of conditions that always assures the collector a rich harvest. In striking contrast to the above localities are the banks of the Eastern Branch, with their extensive marshes of wild rice. Here a great many species were found not occurring elsewhere in the District.

Some representative forms of the austroriparian fauna are found all along the Atlantic coast from Florida to New Jersey, but the majority do not extend more northerly than the Chesapeake region, while certain northern species find their southern limit of distribution in this vicinity.

The following are examples of austroriparian species which find here their northern limit:

Omophron labiatum, *Platynus striatopunctatus* and *picticornis*, *Anatrichis minuta*, *Oelina angustata*, *Bryaxis belfragi*, *Iso reclusa*, *Meristhus scobinula*, *Ischiodontus sulcatus*, *Ozognathus floridanus*, *Edionychis indigoptera*, *Lactica tibialis*, *Mecynotarsus candidus*, *Xylophilus notatus*, *Hyperhagus punctulatus*, *Liopus crassulus*, *Auletes tachygmonides*, *Centorhynchus siculus*, *Ommorphidium lenticollis*, *Chaetocelus setosus*, and others.

Of Alleghenian forms, which find here their southern limit, we have: *Cicindela rugifrons*, *Lebia fuscata*, *Ips confluentus*, *Boros unicolor*, *Loricobius erichsoni*, *Rhinosimus viridiceneus*, *Carebara longula*, *Enchodes sericea*, *Pterostichus corvinus*, *Platynus obsoletus*, *Aculyptus carpini*, and others.

The great bulk of our Coleoptera, however, belongs to the carolinian fauna.

As this manuscript was prepared nearly four years ago, papers on North American Coleoptera that have been published since have not been taken into consideration. Some of the changes in the nomenclature established in these papers have been inserted, but many others could not be attended to.

Everyone familiar with the systematic study of North American Coleoptera is aware that in many genera of various families we have a larger or smaller number of undescribed species; the description of which must by all means be left for future monographs. Such species are omitted in this list; they are most numerous in the subfamily Aleocharinæ of the family Staphylinidæ, in the Cioidæ, Cryptophagidæ, etc.

A local faunal list acquires interest and importance only when compared with lists of adjacent regions. As to Coleoptera we have the list by the late Dr. John Hamilton¹ on the Coleoptera of southwestern Pennsylvania, and that of Dr. J. B. Smith on the insects of New Jersey (second edition, 1899.) Both of these lists refer to regions north of the District of Columbia. Southward we have no comprehensive faunal lists of Virginia, North Carolina, South Carolina, and Georgia. The list of Coleoptera of Florida, by Schwarz and Hubbard² is also of importance for comparison with our District fauna.

It is very gratifying to find that some of the younger enthusiastic students in the Division of Insects in the United States National Museum, and the Division of Entomology in the United States Department of Agriculture, such as H. S. Barber and F. C. Pratt, have taken up coleopterology and already give proof of their success in studying and collecting coleoptera. No doubt many additions will hereafter be made to the species enumerated in this paper.

LIST OF SPECIES.

CICINDELIDÆ.

1. *Tetracha virginea* Linnaeus.
2. *Cicindela rugifrons* Dejean.
3. *6-guttata* Fabricius.
4. var. *puberula* Dejean.
5. *purpurea* Olivier.
6. var. *splendida* Hentz.
7. *vulgaria* Say.
8. *repanda* Dejean.
9. var. *12-guttata* Dejean.
10. *hirticollis* Say.
11. *punctulata* Fabricius.
12. *marginata* Fabricius.
13. *rufiventris* Dejean.

CARABIDÆ.

14. *Omophron latitatum* Fabricius.
15. *americanum* Dejean.
16. *Cycharus stenostomus* Weher.
17. *elevarius* Fabricius.
18. *unicolor* Olivier.
19. *ciduus* Dejean.
20. *Chrodis sylvensis* Say.
21. *serripes* Say.
22. *limbatus* Say.
23. *vinctus* Weher.
24. *Chlorosoma externum* Say.
25. *serripator* Fabricius.
26. *wilcoxi* Le Conte.

¹ Trans. Amer. Ent. Soc., XXII, 1895.

² Proc. Amer. Phil. Soc., XVII, 1878.

LIST OF SPECIES—Continued.

27. *Calosoma sayi* Dejean.
 28. *calidum* Fabricius.
 29. *Elaphrus riparius* Linnaeus.
 30. *ruscarius* Say.
 31. *Notiophilus aeneus* Herbst.
 32. *semistriatus* Le Conte.
 33. *sibiricus* Motschulsky.
 34. *Nebria pallipes* Say.
 35. *Pusimachus sublaevis* Dejean.
 36. *depressus* Fabricius.
 37. *Scarites subterraneus* Fabricius.
 38. *Dyschirius globulosus* Say.
 39. *haemorrhoidalis* Dejean.
 40. *sphaericollis* Say.
 41. *pumilus* Putzeys.
 42. *pilosus* Le Conte.
 43. *Citirina dentipes* Dejean.
 44. *impressifrons* Le Conte.
 45. *planicollis* Le Conte.
 46. *punctigera* Le Conte.
 47. *pallida* Say.
 48. *rufa* Le Conte.
 49. *americana* Dejean.
 50. *morula* Le Conte.
 51. *ferrea* Le Conte.
 52. *bipustulata* Fabricius.
 53. *Aspidoglossa subangulata* Chaudoir.
 54. *Schizogenius lineolatus* Say.
 55. *ferrugineus* Putzeys.
 56. *amphibius* Haldeman.
 57. *Panagaeus fasciatus* Say.
 58. *Bembidium punctatostriatum* Say.
 59. *littorale* Olivier.
 60. *inaequale* Say.
 61. *corendix* Say.
 62. *laevigatum* Say.
 63. *americanum* Dejean.
 64. *antiquum* Dejean.
 65. *chalcicum* Dejean.
 66. *nigrum* Say.
 67. *fugax* Le Conte.
 68. *guelii* Chaudoir.
 69. *ustulatum* Linnaeus.
 70. *picipes* Kirby.
 71. *fraternum* Le Conte.
 72. *dorsale* Say.
 73. *patruele* Dejean.
 74. *variegatum* Say.
 75. *constrictum* Le Conte.
 76. *contractum* Say.
 77. *affine* Say.
 78. *4-maculatum* Linnaeus.
 79. *Bembidium pedicellatum* Le Conte.
 80. *semistriatum* Haldeman.
 81. *Anulus fortis* Horn.
 82. *Tachys proximus* Say.
 83. *scutulus* Le Conte.
 84. *coruscus* Le Conte.
 85. *pumilus* Dejean.
 86. *laevis* Say.
 87. *nanus* Gyllenhal.
 88. *flavicauda* Say.
 89. *tripunctatus* Say.
 90. *revivax* Le Conte.
 91. *capax* Le Conte.
 92. *ranthopus* Dejean.
 93. *ferrugineus* Dejean.
 94. *incurvus* Say.
 95. *var. pulchellus* Laferté.
 96. *gramarius* Dejean.
 97. *dolosus* Le Conte.
 98. *Pericompnus rhippiatus* Say.
 99. *Patrobus longicornis* Say.
 100. *Myus coracinus* Say.
 101. *Pterostichus udoxus* Say.
 102. *rostratus* Newman.
 103. *rotundatus* Le Conte.
 104. *approximatus* Le Conte.
 105. *diligendus* Chaudoir.
 106. *honestus* Say.
 107. *lachrymosus* Newman.
 108. *coracinus* Newman.
 109. *stygius* Say.
 110. *maestus* Say.
 111. *sayi* Brullé.
 112. *lucublandus* Say.
 113. *ebeninus* Dejean.
 114. *caudicatus* Say.
 115. *luctuosus* Dejean.
 116. *corvinus* Dejean.
 117. *gravis* Le Conte.
 118. *mutus* Say.
 119. *erythropus* Dejean.
 120. *femorialis* Kirby.
 121. *Erarthrus sigillatus* Say.
 122. *sodalis* Le Conte.
 123. *Amara arida* Say.
 124. *fulvipes* Putzeys.
 125. *exarata* Dejean.
 126. *angustata* Say.
 127. *impuncticollis* Say.
 128. *basillaris* Say.
 129. *crassispina* Le Conte.
 130. *cupreolata* Putzeys.

LIST OF SPECIES—(continued).

- | | |
|---|--|
| 131. <i>Amara fallax</i> Le Conte. | 182. <i>Olinthopus parvatus</i> Say. |
| 132. <i>interstitius</i> Dejean. | 183. <i>micans</i> Le Conte. |
| 133. <i>chalcona</i> Dejean. | 184. <i>Perigona nigriceps</i> Dejean. |
| 134. <i>rubrica</i> Haldeman. | 185. <i>pullipennis</i> Le Conte |
| 135. <i>musculus</i> Say. | 186. <i>Atranius pubescens</i> Dejean. |
| 136. <i>Loxandrus rectus</i> Say. | 187. <i>Leptotrachelus dorsalis</i> Fabricius. |
| 137. <i>minor</i> Chaudoir. | 188. <i>Casnomia pennsylvanica</i> Linnaeus. |
| 138. <i>erraticus</i> Dejean | 189. <i>ludoviciana</i> Sallé. |
| 139. <i>agilis</i> Dejean. | 190. <i>Galerita janus</i> Fabricius |
| 140. <i>Diplochila laticollis</i> Le Conte. | 191. <i>bicolor</i> Drury. |
| 141. <i>Dicelus dilatatus</i> Say. | 192. <i>Thalpius dorsalis</i> Brullé. |
| 142. <i>purpuratus</i> Bonelli. | 193. <i>Tetragonolerus fuscatus</i> Haldeman |
| 143. <i>oralis</i> Le Conte. | 194. <i>Lebia grandis</i> Hentz. |
| 144. <i>elongatus</i> Bonelli. | 195. <i>atrevensis</i> Say. |
| 145. <i>ambiguus</i> Laferté. | 196. <i>tricolor</i> Say. |
| 146. <i>teter</i> Bonelli. | 197. <i>pulchella</i> Dejean. |
| 147. <i>politus</i> Dejean. | 198. <i>marginecollis</i> Dejean. |
| 148. <i>Badister notatus</i> Haldeman. | 199. <i>viridis</i> Say. |
| 149. <i>pulchellus</i> Le Conte. | 200. <i>var. maesta</i> Le Conte. |
| 150. <i>maculatus</i> Le Conte. | 201. <i>pumila</i> Dejean. |
| 151. <i>flavipes</i> Le Conte. | 202. <i>plurivitta</i> Le Conte. |
| 152. <i>reflexus</i> Le Conte. | 203. <i>viridipennis</i> Dejean. |
| 153. <i>Calathus gregarius</i> Say. | 204. <i>lobulata</i> Le Conte. |
| 154. <i>opaculus</i> Le Conte. | 205. <i>ornatus</i> Say. |
| 155. <i>impunctatus</i> Say. | 206. <i>analis</i> Dejean. |
| 156. <i>Platynus caudatus</i> Le Conte. | 207. <i>fuscata</i> Dejean. |
| 157. <i>decens</i> Say. | 208. <i>abdominalis</i> Chaudoir. |
| 158. <i>sinuatus</i> Dejean. | 209. <i>scapularis</i> Dejean. |
| 159. <i>cincticollis</i> Say. | 210. <i>depicta</i> Horn. |
| 160. <i>reflexus</i> Le Conte. | 211. <i>pectita</i> Horn. |
| 161. <i>extensicollis</i> Say. | 212. <i>bivittata</i> Fabricius. |
| 162. <i>decorus</i> Say. | 213. <i>Coptodera serata</i> Dejean. |
| 163. <i>maerens</i> Dejean. | 214. <i>Dromius piceus</i> Dejean. |
| 164. <i>melanarius</i> Dejean. | 215. <i>Apyritus cordicollis</i> Le Conte. |
| 165. <i>carbo</i> Le Conte. | 216. <i>subsulcatus</i> Dejean. |
| 166. <i>cupripennis</i> Say. | 217. <i>Blechnus glabratus</i> Duftschmidt. |
| 167. <i>excavatus</i> Dejean. | 218. <i>pugio</i> Le Conte. |
| 168. <i>ferreus</i> Haldeman. | 219. <i>Metabletus americanus</i> Dejean. |
| 169. <i>nutans</i> Say. | 220. <i>Plochionus timidus</i> Haldeman. |
| 170. <i>strictopunctatus</i> Dejean. | 221. <i>Pinacodera limbata</i> Dejean. |
| 171. <i>pineticornis</i> Newman. | 222. <i>platicollis</i> Say. |
| 172. <i>8-punctatus</i> Fabricius. | 223. <i>Gymindis elegans</i> Le Conte. |
| 173. <i>placidus</i> Say. | 224. <i>americana</i> Dejean. |
| 174. <i>bogemanni</i> Gyllenhal. | 225. <i>pilosa</i> Say. |
| 175. <i>seruginomus</i> Dejean. | 226. <i>neglecta</i> Haldeman. |
| 176. <i>limbatus</i> Say. | 227. <i>Apenes lucidula</i> Dejean. |
| 177. <i>punctiformis</i> Say. | 228. <i>sinuata</i> Say. |
| 178. <i>crenistratus</i> Le Conte. | 229. <i>Helluomorpha nigripennis</i> Dejean. |
| 179. <i>rubripes</i> Zimmermann. | 230. <i>bicolor</i> Harris. |
| 180. <i>picipennis</i> Kirby. | 231. <i>Brachynus americanus</i> Le Conte. |
| 181. <i>tutulentus</i> Le Conte. | 232. <i>minutus</i> Harris. |

LIST OF SPECIES—Continued.

233. *Brachynus perplexus* Dejean.
 234. *ballistarius* Le Conte.
 235. *funana* Fabricius.
 236. *Chlaenius sericeus* Forster.
 237. *laticollis* Say.
 238. *testivus* Say.
 239. *prasinus* Dejean.
 240. *leucoscelis* Chevrolat.
 241. *nemorialis* Say.
 242. *tricolor* Dejean.
 243. *brevilabris* Le Conte.
 244. *pennsylvanicus* Say.
 245. *impunctifrons* Say.
 246. *niger* Randall.
 247. *tonentosus* Say.
 248. *emarginatus* Say.
 249. *caeruleicollis* Chaudoir.
 250. *Brachylobus lithophilus* Say.
 251. *Lachnoreris parallelus* Say.
 252. *Anatrichia minuta* Dejean.
 253. *Oodes amaroides* Dejean.
 254. *americanus* Dejean.
 255. *Evolenes exaratus* Dejean.
 256. *Geopinus incrassatus* Dejean.
 257. *Cratacanthus rubius* Beauvois.
 258. *Agonoderus lineola* Fabricius.
 259. *pallipes* Fabricius.
 260. *comma* Fabricius.
 261. *pauperculus* Dejean.
 262. *indistinctus* Dejean.
 263. *testaceus* Dejean.
 264. *micrus* Le Conte.
 265. *Discoderus tenebrosus* Le Conte.
 266. *Gynandropus hylacis* Say.
 267. *Harpalus dichrous* Dejean.
 268. *rufipræculus* Say.
 269. *autumnalis* Say.
 270. *erraticus* Say.
 271. *rufiginosus* Fabricius.
 272. *faunus* Say.
 273. *pennsylvanicus* De Geer.
 274. var. *compar* Le Conte.
 275. var. *longior* Kirby.
 276. var. *erythropus* Dejean.
 277. *spudiceus* Dejean.
 278. *herbivagus* Say.
 279. *nitidulus* Chaudoir.
 280. *viduus* Le Conte.
 281. *Selenophorus pedicularius* Dejean.
 282. *gagatinus* Dejean.
 283. *opalinus* Le Conte.
 284. *Selenophorus ellipticus* Dejean.
 285. *Stenolophus carbonarius* Brullé.
 286. *apretus* Dejean.
 287. *fuliginosus* Dejean.
 288. *plebejus* Dejean.
 289. *conjunctus* Say.
 290. *humidus* Hamilton.
 291. *ochropeus* Dejean.
 292. *alternans* Le Conte.
 293. *Aenypalus hydropicus* Le Conte.
 294. *canus* Le Conte.
 295. *rectangulus* Chaudoir.
 296. *Bradycellus linearis* Le Conte.
 297. *rupestris* Say.
 298. var. *parallelus* Chaudoir.
 299. *tautillus* Chaudoir.
 300. *nigriceps* Le Conte.
 301. *Tachycellus badiipennis* Haldeman.
 302. *atrimedius* Say.
 303. *Anisodactylus ruficornis* Say.
 304. *carbonarius* Say.
 305. *agricola* Say.
 306. *nigerrimus* Dejean.
 307. *nugrita* Dejean.
 308. *discoideus* Dejean.
 309. *baltimorensis* Say.
 310. *lætus* Dejean.
 311. *caenus* Say.
 312. *sericeus* Harris.
 313. *Xestonotus lugubris* Dejean.
 314. *Amphasia interstitialis* Say.
 315. *Anisotarsus terminatus* Say.
 316. *nitidipennis* Le Conte.
 317. *Spongopus verticillatus* Le Conte.
- HALIPLIDÆ.**
318. *Haliphys fasciatus* Aubé.
 319. *punctatus* Aubé.
 320. *triopsis* Say.
 321. *ruficollis* De Geer.
 322. *Quemulotus simplex* Le Conte.
 323. *12-punctatus* Say.
- DYTISCIDÆ.**
324. *Canthidrus bicolor* Say.
 325. *puncticollis* Crotch.
 326. *Hydrocanthus iricolor* Say.
 327. *Laccophilus maculosus* Germar.
 328. *fasciatus* Aubé.
 329. *proximus* Say.
 330. *undatus* Aubé.

LIST OF SPECIES—Continued.

- | | |
|--|---|
| 331. <i>Hydrovatus pustulatus</i> Melsheimer. | 378. <i>Dineutes nigrior</i> Roberts. |
| 332. <i>Dromopachria curvata</i> Aubé | 379. <i>Gyrinus rockinghamensis</i> Zimmer- |
| 333. <i>Bidessus flavicollis</i> Le Conte. | mann. |
| 334. <i>affinis</i> Say. | 380. <i>aneolus</i> Le Conte. |
| 335. <i>lucustris</i> Say. | 381. <i>ventralis</i> Kirby. |
| 336. <i>granarius</i> Aubé | 382. <i>analis</i> Say. |
| 337. <i>Celma angustatus</i> Aubé. | |
| 338. <i>Cyclambus nubilus</i> Le Conte. | |
| 339. <i>dissimilis</i> Gemminger and | |
| Harold | |
| 340. <i>Hydroporus concinnus</i> Le Conte. | 383. <i>Helophorus lineatus</i> Say. |
| 341. <i>pulcher</i> Le Conte. | 384. <i>inquinatus</i> Mannerheim. |
| 342. <i>mellitus</i> Le Conte. | 385. <i>Hydrochus scabratus</i> Mulsant. |
| 343. <i>inornatus</i> Sharp. | 386. <i>inqualis</i> Le Conte |
| 344. <i>niger</i> Say. | 387. <i>subcupreus</i> Randall. |
| 345. <i>modestus</i> Aubé. | 388. <i>Hydrichus pennsylvanicus</i> Kiesenwet- |
| 346. <i>oblitus</i> Aubé. | ter. |
| 347. <i>undulatus</i> Say | 389. <i>Hydrophilus triangularis</i> Say. |
| 348. <i>consimilis</i> Le Conte. | 390. <i>oratus</i> Gemminger and |
| 349. <i>proximus</i> Aubé. | Harold. |
| 350. <i>retiosus</i> Le Conte. | 391. <i>Tropisternus nimbatus</i> Say. |
| 351. <i>aericens</i> Le Conte. | 392. <i>glaber</i> Herbst. |
| 352. <i>striatopunctatus</i> Mels- | 393. <i>striolatus</i> Le Conte. |
| heimer. | 394. <i>Hydrochus obtusus</i> Say. |
| 353. <i>americanus</i> Aubé. | 395. <i>Berosus peregrinus</i> Herbst. |
| 354. <i>Ptychus biguttulus</i> Germar. | 396. <i>eriguus</i> Say. |
| 355. <i>Coptotomus interrogatus</i> Fabricius. | 397. <i>striatus</i> Say. |
| 356. <i>Copelatus glypticus</i> Say. | 398. <i>Laccobius agilis</i> Randall |
| 357. <i>Matus bicarinatus</i> Say. | 399. <i>Philhydrus nebulosus</i> Say. |
| 358. <i>Agabates aculeatus</i> Harris. | 400. <i>ochraceus</i> Melsheimer. |
| 359. <i>Agabus seriatus</i> Say. | 401. <i>cinctus</i> Say. |
| 360. <i>obtusatus</i> Say. | 402. <i>perplexus</i> Le Conte |
| 361. <i>stagninus</i> Say | 403. <i>Helochares maculicollis</i> Mulsant |
| 362. <i>disintegratus</i> Grotch. | 404. <i>Helocombus bipidis</i> Le Conte. |
| 363. <i>erythropterus</i> Say. | 405. <i>Cymbiodyla flabrida</i> Melsheimer. |
| 364. <i>gagates</i> Aubé. | 406. <i>blanchardi</i> Horn. |
| 365. <i>Rhantus ciliatus</i> Fabricius. | 407. <i>Hydrobius fuscipes</i> Linnaeus. |
| 366. <i>Hydaticus bimarginatus</i> Say. | 408. <i>globosus</i> Say. |
| 367. <i>Dytiscus hybridus</i> Aubé. | 409. <i>tessellatus</i> Ziegler. |
| 368. <i>Arillus medius</i> Say. | 410. <i>Cremophilus subcupreus</i> Say. |
| 369. <i>Thermonectes ornaticollis</i> Aubé. | 411. <i>mutualis</i> Le Conte. |
| 370. <i>basilaris</i> Harris. | 412. <i>Phaenonotum exstriatum</i> Say. |
| 371. <i>Graphoderes liberus</i> Say. | 413. <i>Cereyon unipunctatus</i> Linnaeus. |
| 372. <i>Gylister flabrolatus</i> Say. | 414. <i>pratensis</i> Say. |
| | 415. <i>indistinctus</i> Horn. |
| | 416. <i>analis</i> Paykull. |
| | 417. <i>analis</i> var. ? |
| | 418. <i>lunulatus</i> Paykull. |
| | 419. <i>hemorrhoidalis</i> Fabricius. |
| | 420. <i>nigripes</i> Marsham. |
| | 421. <i>pugnax</i> Illiger. |
| | 422. <i>melanocephalus</i> Linnaeus. |
| | 423. <i>rararius</i> Erichson. |

LIST OF SPECIES—Continued.

424. *Cercyon navicularis* Zimmermann.
 425. *pubescens* Le Conte.
 426. *Cryptopleurum minutum* Fabricius.
 427. *americanum* Horn.
 428. *Pemelus costatus* Le Conte.

LEPTINIDÆ.

429. *Leptinus testaceus* Müller.

SILPHIDÆ.

430. *Necrophorus americanus* Olivier.
 431. *orbicollis* Say.
 432. *marginatus* Fabricius.
 433. *tomentosus* Weber.
 434. *Silpha aurinamensis* Weber.
 435. *lapponica* Herbst.
 436. *inequalis* Fabricius.
 437. *noveboracensis* Forster.
 438. *americana* Linnæus.
 439. *Pinodytes cryptophagoides* Mannerheim.
 440. *Cholera luridipennis* Mannerheim.
 441. *simplex* Say.
 442. *clavicornis* Le Conte.
 443. *terminans* Le Conte.
 444. *Prionocheila opaca* Say.
 445. *Ptomaphagus consobrinus* Le Conte.
 446. *ulkei* Horn.
 447. *oblitus* Le Conte.
 448. *parasitus* Le Conte.
 449. *Colon paradoxum* Horn.
 450. *hubbardi* Horn.
 451. *putum* Horn.
 452. *pusillum* Horn.
 453. *thoracicum* Horn.
 454. *asperatum* Horn.
 455. *Anisotoma alternata* Melsheimer.
 456. *assimilis* Le Conte.
 457. *collaris* Le Conte.
 458. *obsoleta* Melsheimer.
 459. *Colenis impunctatus* Le Conte.
 460. *Liontes discolor* Melsheimer.
 461. *obsoleta* Horn.
 462. *basalis* Le Conte.
 463. *geminata* Horn.
 464. *Cyrtusa picipennis* Le Conte.
 465. *blandissima* Zimmermann.
 466. *egena* Le Conte.
 467. *Isoplastus fossor* Horn.
 468. *Agathidium oniscoides* Beauvois.
 469. *exiguum* Melsheimer.
 470. *Aglyptus lavis* Le Conte.
 471. *Clambus gibbulus* Le Conte.
 472. *puberulus* Le Conte.

SCYDMENIDÆ.

473. *Chevroletia amara* Le Conte.
 474. *Brachycephus subpunctatus* Le Conte.
 475. *cribrarius* Le Conte.
 476. *perforatus* Schaum.
 477. *Scydmaenus flavitarsis* Le Conte.
 478. *fossiger* Le Conte.
 479. *capillosus* Le Conte.
 480. *basalis* Le Conte.
 481. *hirtellus* Le Conte.
 482. *analis* Le Conte.
 483. *brevicornis* Say.
 484. *ramus* Le Conte.
 485. *obscurulus* Le Conte.
 486. *clavatus* Le Conte.
 487. *clavipes* Say.
 488. *consobrinus* Le Conte.
 489. *lecontei* Schaum.
 490. *salinator* Le Conte.
 491. *fatuus* Le Conte.
 492. *misellus* Le Conte.
 493. *fulvus* Le Conte.
 494. *pyramidalis* Le Conte.
 495. *Fumicrus grossus* Le Conte.
 496. *Motschulskii* Le Conte.
 497. *Cholerus zimmermanni* Schaum.
 498. *Cephenidium corporosum* Le Conte.

PSELAPHIDÆ.

499. *Adranes lecontei* Brendel.
 500. *Ceophyllus monilis* Le Conte.
 501. *Cedrus zieglei* Le Conte.
 502. *spinosa* Le Conte.
 503. *Thnesiphorus costalis* Le Conte.
 504. *carinatus* Le Conte.
 505. *Chennium monilicorne* Brendel.
 506. *Ctenistes piceus* Le Conte.
 507. *consobrinus* Le Conte.
 508. *zimmermanni* Le Conte.
 509. *Tyrus hanneralis* Aubé.
 510. *Pselaphus erichsonii* Le Conte.
 511. *Tychus longipalpus* Le Conte.
 512. *minor* Le Conte.
 513. *Eutrichites zimmermanni* Le Conte.
 514. *Nisaxis tomentosa* Aubé.
 515. *Decarthron alnorne* Le Conte.
 516. *exsectum* Brendel.

LIST OF SPECIES—Continued.

517. *Decarthron stigosum* Brendel.
 518. *longulum* Brendel.
 519. *formiceti* Le Conte.
 520. *Bryaxis valida* Brendel.
 521. *conjuncta* Le Conte.
 522. *luniger* Le Conte.
 523. *curicornis* Brendel.
 524. *abdominalis* Aubé.
 525. *floridana* Brendel.
 526. *intermedia* Brendel.
 527. *ulkei* Brendel.
 528. *illinoiensis* Brendel.
 529. *dentata* Say.
 530. *perforata* Brendel.
 531. *helfrugi* Le Conte.
 532. *grinnifer* Le Conte.
 533. *atlantica* Brendel.
 534. *congener* Brendel.
 535. *rubicunda* Aubé.
 536. *puncticollis* Le Conte.
 537. *Arthinius globicollis* Le Conte.
 538. *Batrissus ionæ* Le Conte.
 539. *ferax* Le Conte.
 540. *monstruosus* Le Conte.
 541. *schaumi* Aubé.
 542. *riparius* Aubé.
 543. *scabriceps* Le Conte.
 544. *bistrictus* Le Conte.
 545. *globosus* Le Conte.
 546. *spretus* Le Conte.
 547. *punctifrons* Casey.
 548. *denticollis* Casey.
 549. *triangulifer* Brendel.
 550. *nigricans* Le Conte.
 551. *Trimium globifer* Le Conte.
 552. *impunctatum* Brendel.
 553. *discolor* Le Conte.
 554. *parvulum* Le Conte.
 555. *convexulum* Le Conte.
 556. *dubium* Le Conte.
 557. *simplex* Le Conte.
 558. *Rhexidius cumulicollatus* Le Conte.
 559. *Rhexius insculptus* Le Conte.
 560. *Thesium curvifrons* Le Conte.
 561. *Trimiopectus arcuatus* Le Conte.
 562. *Euplectus lericeps* Casey.
 563. *interruptus* Le Conte.
 564. *difficilis* Le Conte.
 565. *congener* Casey.
 566. *linearis* Le Conte.
 567. *Euplectus confusus* Le Conte.
 568. *pertenuis* Casey.
 569. *Eutypheus similis* Le Conte.
- STAPHYLINIDÆ.
570. *Allochara*¹ *lata* Gravenhorst.
 571. *brachyptera* Fourcroy.
 572. *himaculata* Gravenhorst.
 573. *nitida* Gravenhorst.
 574. *Craturoa suturalis* Mannerheim.
 575. *Oxyptoda*² *sagulata* Erichson.
 576. *minuta* Sachse.
 577. *Ocyusa asperula* Casey.
 578. *Thinasophila angustiventris* Casey.
 579. *Ocaleu* sp.
 580. *Philocopora ludens* Erichson.
 581. *Xenodusa atra* Le Conte.
 582. *Myrmedonius rudis* Le Conte.
 583. *planifera* Casey.
 584. *loricata* Casey.
 585. *caliginosa* Casey.
 586. *schwarzii* Wasmann.
 587. *Philothermes pennsylvanicus* Kraatz.
 588. *pilosus* Kraatz.
 589. *Callicerus*, two species.
 590. *Hoplandria*² *lateralis* Melsheimer.
 591. *Trichiusa*³ *compacta* Casey.
 592. *Atheta*³ *semula* Erichson.
 593. *clichron* Gravenhorst.
 594. *luteola* Erichson.
 595. *recondita* Erichson.
 596. *unalis* Gravenhorst.
 597. *lividipennis* Mannerheim.
 598. *Tachyusa gracillima* Le Conte.
 599. *nigrella* Le Conte.
 600. *baltifera* Le Conte.
 601. *Falagriu bilobata* Say.
 602. *cingulata* Le Conte.
 603. *dissecta* Erichson.
 604. *quadriceps* Le Conte.
 605. *venustula* Erichson.
 606. *Bolitochura trimaculata* Erichson.
 607. *Myrmecochara debilis* Wasmann.
 608. *Euryusa obtusa* Le Conte.
 609. *Leptusa*³ *opaca* Casey.
 610. *Silusa*.⁴
 611. *Homalota plana* Gyllenhal.
 612. *Placusa*.²
 613. *Gyrophæna*⁵ *vinula* Erichson.
 614. *flavicornis* Melsheimer.

¹ One species undetermined.² Several undetermined species.³ Many undetermined species.⁴ Three undetermined species.⁵ About eight undetermined species.

LIST OF SPECIES—Continued.

615. <i>Cyrophæna corruscata</i> Erichson.	662. <i>Philonthus cunctans</i> Horn.
616. <i>Oligota</i> ¹ <i>pedalis</i> Le Conte.	663. <i>aqualis</i> Horn.
617. <i>Myllæna</i> ² <i>infuscula</i> Kraatz.	664. <i>brunneus</i> Gravenhorst.
618. <i>Dinopsis americanus</i> Kraatz.	665. <i>cyanipectus</i> Fabricius.
619. <i>myllænoides</i> Kraatz. ³	666. <i>blandus</i> Gravenhorst.
620. <i>Acrylaphorus flavicollis</i> Sachse.	667. <i>cephalotes</i> Gravenhorst.
621. <i>pronus</i> Erichson.	668. <i>inquietus</i> Erichson.
622. <i>densus</i> Le Conte.	669. <i>ventralis</i> Gravenhorst.
623. <i>Heterothops pusio</i> Le Conte.	670. <i>microplthamnus</i> Horn.
624. <i>Quedius ferox</i> Le Conte.	671. <i>baltimorensis</i> Graven-
625. <i>fulgidus</i> Fabricius.	horst.
626. <i>peregrinus</i> Gravenhorst.	672. <i>apicalis</i> Say.
627. <i>cupricinus</i> Gravenhorst.	673. <i>Actobius cinerascens</i> Gravenhorst.
628. <i>molochinus</i> Gravenhorst.	674. <i>procerulus</i> Gravenhorst.
629. <i>Listrotroplus emgulatus</i> Gravenhorst.	675. <i>sobrinus</i> Erichson.
630. <i>Treophilus villosus</i> Gravenhorst.	676. <i>putella</i> Horn.
631. <i>Staphylinus vulpinus</i> Nordmann.	677. <i>laxatus</i> Horn.
632. <i>maculosus</i> Gravenhorst.	678. <i>parvus</i> Horn.
633. <i>mysticus</i> Erichson.	679. <i>paederoides</i> Horn.
634. <i>tomentosus</i> Gravenhorst.	680. <i>jocosus</i> Horn.
635. <i>fossator</i> Gravenhorst.	681. <i>terminalis</i> Le Conte.
636. <i>comes</i> Le Conte.	682. <i>lepidulus</i> Le Conte.
637. <i>cinnamopterus</i> Graven-	683. <i>Xantholinus fulgidus</i> Fabricius.
horst.	684. <i>cephalus</i> Say.
638. <i>violaceus</i> Gravenhorst.	685. <i>obsidianus</i> Melsheimer.
639. <i>viridans</i> Horn.	686. <i>emneus</i> Gravenhorst.
640. <i>exilis</i> Erichson.	687. <i>hamatus</i> Say.
641. <i>prælongus</i> Mannerheim.	688. <i>temporalis</i> Le Conte.
642. <i>Ocypus ater</i> Gravenhorst.	689. <i>Leptolinus rubripennis</i> Le Conte.
643. <i>Belonuchus formosus</i> Gravenhorst.	690. <i>Leptacinus longicollis</i> Le Conte.
644. <i>Tympanophorus puncticollis</i> Erichson.	691. <i>nigritulus</i> Le Conte.
645. <i>Philonthus politus</i> Linneus.	692. <i>cephalicus</i> Le Conte.
646. <i>umbratilis</i> Gravenhorst.	693. <i>Dioclus schwanii</i> Kraatz.
647. <i>betulus</i> Say.	694. <i>Stenus bipunctatus</i> Erichson.
648. <i>asper</i> Horn.	695. <i>colon</i> Say.
649. <i>hepaticus</i> Erichson.	696. <i>semicolum</i> Le Conte.
650. <i>umbrinus</i> Gravenhorst.	697. <i>delawarensis</i> Casey.
651. <i>pallidus</i> Gravenhorst.	698. <i>militaris</i> Casey.
652. <i>debilis</i> Gravenhorst.	699. <i>colonus</i> Erichson.
653. <i>varians</i> Paykull.	700. <i>stygius</i> Say.
654. <i>longicornis</i> Stephens.	701. <i>egens</i> Erichson.
655. <i>discoidens</i> Gravenhorst.	702. <i>seclifer</i> Casey.
656. <i>thermarum</i> Aubé.	703. <i>carolinæ</i> Casey.
657. <i>alunus</i> Erichson.	704. <i>argus</i> Gravenhorst.
658. <i>thoracicus</i> Gravenhorst.	705. <i>dispar</i> Casey.
659. <i>fusiformis</i> Melsheimer.	706. <i>croceatus</i> Casey.
660. <i>fulripes</i> Fabricius.	707. <i>flavicornis</i> Erichson.
661. <i>lomatius</i> Erichson.	708. <i>annularis</i> Erichson.

¹ Several undetermined species.² Several species.³ A large number of species belonging to different genera of the subfamily Aleocharinae still remain undetermined.

LIST OF SPECIES—Continued.

709. <i>Stenus collaris</i> Erichson.	759. <i>Tachinus memnonius</i> Gravenhorst.
710. <i>arcuatus</i> Erichson.	760. <i>luridus</i> Erichson.
711. <i>punctatus</i> Erichson.	761. <i>flavipennis</i> Dejean.
712. <i>Eucasthetus americanus</i> Erichson.	762. <i>repandus</i> Horn.
713. <i>Edaphus nitidus</i> Le Conte	763. <i>fimbriatus</i> Gravenhorst.
714. <i>Stictocranius puncticeps</i> Le Conte	764. <i>picipes</i> Erichson
715. <i>Cryptobium badium</i> Gravenhorst	765. <i>limbatus</i> Melsheimer.
716. <i>bicolor</i> Gravenhorst.	766. <i>funipennis</i> Say.
717. <i>carolinum</i> Erichson.	767. <i>nitiduloides</i> Horn.
718. <i>pallipes</i> Gravenhorst	768. <i>pallipes</i> Gravenhorst.
719. <i>latebricola</i> Nordmann.	769. <i>Tachyporus maculipennis</i> Le Conte.
720. <i>flavicornis</i> Le Conte.	770. <i>elegans</i> Horn.
721. <i>cribratum</i> Le Conte.	771. <i>jocosus</i> Say.
722. <i>serpentinum</i> Le Conte.	772. <i>chrysomellinus</i> Linnaeus.
723. <i>Lathrobium terminatum</i> Gravenhorst.	773. <i>nitidulus</i> Fabricius.
724. <i>angulare</i> Le Conte.	774. <i>nanus</i> Erichson.
725. <i>armatum</i> Say.	775. <i>Cylen sulphureus</i> Linnaeus.
726. <i>smile</i> Le Conte.	776. <i>Erichsonius ventriculus</i> Say.
727. <i>longiusculum</i> Graven-	777. <i>lavis</i> Le Conte.
horst.	778. <i>Conosoma knoeii</i> Le Conte.
728. <i>collare</i> Erichson.	779. <i>crassum</i> Gravenhorst.
729. <i>ambiguum</i> Le Conte.	780. <i>parrulum</i> Horn.
730. <i>ventrale</i> Le Conte.	781. <i>basale</i> Erichson.
731. <i>anale</i> Le Conte.	782. <i>opicum</i> Say.
732. <i>pallidulum</i> Le Conte.	783. <i>scriptum</i> Horn.
733. <i>dimidiatum</i> Say.	784. <i>Bolitobius niger</i> Gravenhorst.
734. <i>Scopaeus exiguus</i> Erichson.	785. <i>dimidiatus</i> Erichson.
735. <i>opacus</i> Le Conte.	786. <i>intrusus</i> Horn.
736. <i>nitidus</i> Le Conte.	787. <i>cincticollis</i> Say.
737. <i>Stilpnus tristis</i> Melsheimer.	788. <i>anticus</i> Horn.
738. <i>opaculus</i> Le Conte.	789. <i>angularis</i> Sachse.
739. <i>angularis</i> Le Conte.	790. <i>tricoloratus</i> Erichson.
740. <i>dentatus</i> Say.	791. <i>obsoletus</i> Say.
741. <i>biarmatus</i> Le Conte.	792. <i>cinctus</i> Gravenhorst.
742. <i>rufus</i> Le Conte.	793. var. <i>gentilis</i> Le Conte
743. <i>Lithocharis</i> ¹ <i>ochracea</i> Gravenhorst.	794. <i>Bryoporus flavipes</i> Le Conte.
744. <i>Aderocharis corticina</i> Gravenhorst.	795. <i>rufescens</i> Le Conte.
745. <i>Trachysectus confluentis</i> Say.	796. <i>Mycetoporus humidus</i> Say.
746. <i>Pederus littorarius</i> Gravenhorst.	797. <i>tenax</i> Horn
747. <i>Sminthus prolixus</i> Erichson.	798. <i>consors</i> Le Conte.
748. <i>binotatus</i> Say.	799. <i>americanus</i> Erichson.
749. <i>longiusculus</i> Mannerheim.	800. <i>flavicollis</i> Le Conte.
750. <i>Echiaster brevicornis</i> Casey.	801. <i>splendidus</i> Gravenhorst.
751. <i>Stilicopsis monstrosa</i> Le Conte.	802. <i>Pseudopsis sulcata</i> Newman.
752. <i>paradora</i> Sachse.	803. <i>Megalops exelatus</i> Gravenhorst.
753. <i>Pinophilus picipes</i> Erichson.	804. <i>Oxyporus femoralis</i> Gravenhorst.
754. <i>latipes</i> Erichson.	805. <i>major</i> Gravenhorst.
755. <i>opacus</i> Le Conte.	806. <i>stygius</i> Say.
756. <i>Pylaminus testaceus</i> Erichson.	807. <i>rufipennis</i> Le Conte.
757. <i>contortus</i> Le Conte.	808. <i>vittatus</i> Gravenhorst.
758. <i>Microcypus testaceus</i> Le Conte.	809. <i>fasciatus</i> Melsheimer.

¹ About five other unnamed species.

LIST OF SPECIES—Continued.

810. *Oryporus bicolor* Fauvel.
 811. *lateralis* Gravenhorst.
 812. *occipitalis* Fauvel.
 813. *lepidus* Le Conte.
 814. *5-maculatus* Le Conte.
 815. *Ocorus latipes* Erichson.
 816. *Holotrochus laevicauda* Le Conte.
 817. *Bledius mandibularis* Erichson.
 818. *semiferrugineus* Le Conte.
 819. *analis* Le Conte.
 820. *sinuatus* Le Conte.
 821. *annularis* Le Conte.
 822. *confusus* Le Conte.
 823. *emarginatus* Say.
 824. *Platystethus americanus* Erichson.
 825. *Oryctes incolumis* Erichson.
 826. *sculptus* Gravenhorst.
 827. *pennsylvanicus* Erichson.
 828. *lugens* Marsham.
 829. *insignitus* Gravenhorst.
 830. *suspectus* Casey.
 831. *placuosus* Le Conte.
 832. *nanus* Erichson.
 833. *exiguus* Erichson.
 834. *Trogophlaeus quadripunctatus* Say.
 835. *arcifer* Le Conte.
 836. *memnonius* Erichson.
 837. *corvinus* Casey.
 838. *fulripes* Erichson.
 839. *subtilis* Erichson.
 840. *uniformis* Le Conte.
 841. *spretus* Casey.
 842. *difficilis* Casey.
 843. *riparius* Lacordaire.
 844. *fuliginosus* Gravenhorst.
 845. *pusillus* Gravenhorst.
 846. *tenellus* Erichson.
 847. *Apocellus sphaericollis* Erichson.
 848. *Ancyrophorus*.¹
 849. *Thinobius fimbriatus* Le Conte.
 850. *Geodromicus crenus* Erichson.
 851. *nigrita* Müller.
 852. *Lesteva pallipes* Le Conte.
 853. *Acidota subcarinata* Erichson.
 854. *Arpedium schwarzi* Fauvel.
 855. *Olophrum obtectum* Erichson.
 856. *Homalium** *humerosum* Fauvel.
 857. *repandum* Erichson.
 858. *cribrum* Fauvel.
 859. *diffusum* Fauvel.
 860. *rufipes* Fourcroy.
 861. *Homalium fractum* Fauvel.
 862. *lanatum* Fauvel.
 863. *Anthobium converum* Fauvel.
 864. *Ephelis notata* Le Conte.
 865. *guttata* Le Conte.
 866. *Protinus atomarius* Erichson.
 867. *Megarthus americanus* Sachse.
 868. *Lispinus exiguus* Erichson.
 869. *Glyptoma costale* Erichson.
 870. *Triga picipennis* Le Conte.
 871. *Eleusis pallida* Le Conte.
 872. *nigrella* Le Conte.
 873. *Siagonium americanum* Melsheimer.
 874. *Micropeplus cribratus* Le Conte.
- TRICHOPTERYGIDÆ.
875. *Nossidium americanum* Motschulsky.
 876. *Ptilium collini* Macklin.
 877. *Ptenidium foreicollis* Le Conte.
 878. *speculifer* Matthews.
 879. *evanescent* Marsham.
 880. *lineatum* Le Conte.
 881. *Limulodes paradoxus* Matthews.
 882. *Pteryx balteata* Le Conte.
 883. *Ptenellodes lecontei* Matthews.
 884. *Trichopteryx*³ *parallela* Motschulsky.
 885. *haldemani* Le Conte.
 886. *abrupta* Haldeman.
 887. *aspera* Haldeman.
 888. *macrens* Matthews.
 889. *sericans* Heer.
 890. *glabriceollis* Matthews.
 891. *Smicrus filicornis* Fairmaire.
 892. *Ptinella quercus* Le Conte.
 893. *pini* Le Conte.
 894. *Nephnes leviusculus* Matthews.
- SCAPHIDIIDÆ.
895. *Scaphidium obliteratum* Le Conte.
 896. *quadriguttatum* Say.
 897. *var. picum* Melsheimer.
 898. *Cyparium flavipes* Le Conte.
 899. *Brocera concolor* Fabricius.
 900. *apicalis* Le Conte.
 901. *Toxidium gammaroideus* Le Conte.
 902. *Scaphisoma convexum* Say.
 903. *punctulatum* Le Conte.
 904. *suturale* Le Conte.
 905. *terminatum* Melsheimer.
 906. *pusillum* Le Conte.

¹ Undescribed species.² And several undescribed species.³ Several undescribed species.

LIST OF SPECIES—Continued.

<i>PHALACRIDÆ.</i>		952. <i>Brachyuraantha dentipes</i> Fabricius.
907. <i>Phalacrus penicillatus</i> Say.		953. <i>ursina</i> Fabricius.
908. <i>pohus</i> Melsheimer		954. var. <i>flavifrons</i> Mulsant.
909. <i>pumilio</i> Le Conte.		
910. <i>Olibrus lecontei</i> Casey	955.	var. <i>10-pustulata</i> Melsheimer.
911. <i>piceus</i> Casey		
912. <i>striatulus</i> Le Conte.	956.	var. <i>basalis</i> Melsheimer.
913. <i>consimilis</i> Melsheimer.		
914. <i>nitidus</i> Melsheimer	957.	<i>4-punctata</i> Melsheimer.
915. <i>pusillus</i> Le Conte.		
916. <i>Litochrus immaculatus</i> Casey.	958.	<i>indubitabilis</i> Crotch.
917. <i>Litochrupus sculptus</i> Casey	959. <i>Hyperaspis fimbriolata</i> Melsheimer.	
<i>CORYLOPHIDÆ.</i>		960. <i>undulata</i> Say.
918. <i>Sacium fuscitatum</i> Say.		961. <i>lewisi</i> Crotch.
919. <i>lepidum</i> Le Conte.	962.	<i>signata</i> Olivier.
920. <i>lunatum</i> Le Conte.	963.	<i>proba</i> Say.
921. <i>misellum</i> Le Conte.	964.	<i>bigeminata</i> Randall
922. <i>splendens</i> Schwarz.	965.	<i>pratensis</i> Le Conte.
923. <i>scitulum</i> Le Conte.	966. <i>Seymourus myrmidon</i> Mulsant.	
924. <i>Arthrolips marginicollis</i> Le Conte.	967.	<i>quadrinotatus</i> Le Conte.
925. <i>Corylophus truncatus</i> Le Conte.	968.	<i>xanthaspis</i> Mulsant.
926. <i>Sericoderus flavidus</i> Le Conte.	969.	<i>terminatus</i> Say.
927. <i>obscurus</i> Le Conte.	970.	<i>intrusus</i> Horn.
928. <i>subtilis</i> Le Conte.	971.	<i>flavifrons</i> Melsheimer.
929. <i>Orthoperus glaber</i> Le Conte.	972.	var. <i>bioculatus</i> Mulsant.
<i>COCCINELLIDÆ.</i>		973. <i>americanus</i> Mulsant.
930. <i>Anisosticta seriata</i> Melsheimer.	974.	<i>fraternus</i> Le Conte.
931. <i>Megilla maculata</i> De Geer.	975.	<i>collaris</i> Melsheimer.
932. <i>Hippodamia glacialis</i> Fabricius.	976.	<i>cervicalis</i> Mulsant.
933. <i>convergens</i> Guérin.	977.	<i>tenebrosus</i> Mulsant.
934. <i>13-punctata</i> Linnaeus.	978.	<i>punctum</i> Le Conte.
935. <i>parenthesis</i> Say.	979.	<i>nanus</i> Le Conte.
936. <i>Coccinella affinis</i> Randall.	980.	<i>punctatus</i> Melsheimer.
937. <i>9-notata</i> Herbst.	981. <i>Cephaloscymnus zimmermanni</i> Crotch.	
938. <i>sanguinea</i> Linnaeus.	982. <i>Epilachna borealis</i> Fabricius.	
939. <i>oculata</i> Fabricius.	<i>ENDOMYCHIDÆ.</i>	
940. var. <i>abdominalis</i> Say.	983. <i>Aleria lobata</i> Le Conte.	
941. <i>Adalia bipunctata</i> Linnaeus.	984. <i>Anamorphus pusillus</i> Zimmerman.	
942. <i>Harmonia picta</i> Randall.	985. <i>Symbiotes ulkei</i> Crotch.	
943. <i>Mysia pullata</i> Say.	986. <i>minor</i> Crotch.	
944. <i>Anatis ocellata</i> Linnaeus.	987. <i>Mycetza hirta</i> Marsham.	
945. <i>Psyllobora 20-maculata</i> Say.	988. <i>Rhunis unicolor</i> Ziegler.	
946. <i>Chilocorus viridulus</i> Mulsant.	989. <i>Liestes</i> . ¹	
947. <i>Ecochonus marginipennis</i> Le Conte.	990. <i>Phymaphora pulchella</i> Newman.	
948. <i>3-pustulatus</i> De Geer.	991. <i>Lycoperdina ferruginea</i> Le Conte.	
949. <i>Cryptognatha pusilla</i> Le Conte.	992. <i>Aphorista vittata</i> Fabricius.	
950. <i>Smilia marginata</i> Le Conte.	993. <i>Mycetina testacea</i> Fabricius.	
951. <i>misella</i> Le Conte.	994. <i>perpulchra</i> Newman.	
	995. <i>Stenotarsus hispidus</i> Herbst.	
	996. <i>Endomychus biguttatus</i> Say.	

¹Species not described.

LIST OF SPECIES—Continued.

EROTYLIDÆ

997. *Lauguria bicolor* Fabricius.
 998. *mozardi* Latreille.
 999. *angustata* Beauvois.
 1000. var. *bifasciata* Say.
 1001. *lecontei* Crotch.
 1002. *Acrophorops gracilis* Newman.
 1003. *Eucistus punctatus* Le Conte.
 1004. *Dacne f-maculata* Say.
 1005. *Megalodacne fasciata* Fabricius.
 1006. *hvos* Say.
 1007. *Ischnus f-punctatus* Olivier.
 1008. *Myocictus sanguinipennis* Say.
 1009. *pulchra* Say.
 1010. *Tritoma humilis* Fabricius.
 1011. var. *atlica* Horn.
 1012. *biguttata* Say.
 1013. *mimeticus* Crotch.
 1014. *erythrocephala* Lacordaire.
 1015. *angulata* Say.
 1016. *affinis* Lacordaire.
 1017. *unicolor* Say.
 1018. *thoracica* Say.
 1019. *flavicollis* Lacordaire.

COLYDIDÆ.

1020. *Synchila laticollis* Le Conte.
 1021. *obscura* Horn.
 1022. *parvula* Guérin.
 1023. *fuliginosa* Melsheimer.
 1024. *granulata* Say.
 1025. *Cleonus marginalis* Melsheimer.
 1026. *Ditoma quadriguttata* Say.
 1027. *quadricollis* Horn.
 1028. *Chorelus guttulatus* Le Conte.
 1029. *Lacmonotus referendarius* Zimmermann.
 1030. *Autonium parallelopipedum* Say.
 1031. *tuberculatum* Le Conte.
 1032. *Colydium lineola* Say.
 1033. var. *nigripennis* Le Conte.
 1034. *Aglenus brunneus* Gyllenhal.
 1035. *Oxytelmus americanus* Le Conte.
 1036. *Penthetipa hamatodes* Fabricius.
 1037. *reflexa* Say.
 1038. *Pycnomerus sulcicollis* Le Conte.
 1039. *Bothriderus genivittatus* Say.
 1040. *Erotylidius exaratus* Melsheimer.
 1041. *Cerylon caucaneum* Say.
 1042. *Philetismus glaberrimus* Le Conte.

MURMIDIDÆ.

1043. *Murmichus oratus* Beek.
 1044. *Mychoecus depressus* Le Conte.

RHYSSODIDÆ.

1045. *Rhyssodes caratus* Illiger.
 1046. *Chimidium sculptile* Newman.

CUCULIDÆ

1047. *Silvanus surinamensis* Linnaeus.
 1048. *bidentatus* Fabricius.
 1049. *planatus* Germar.
 1050. *umbellus* Le Conte.
 1051. *adrenus* Waltl.
 1052. *rectus* Le Conte.
 1053. *Nausibius claricornis* Kugelann.
 1054. *repandus* Le Conte.
 1055. *Catogenus rufus* Fabricius.
 1056. *Pediacus depressus* Herbst.
 1057. *Cucujus clampus* Fabricius.
 1058. *Ino reclusa* Le Conte.
 1059. *Lamophtus biguttatus* Say.
 1060. *fasciatus* Melsheimer.
 1061. *modestus* Say.
 1062. *convexus* Le Conte.
 1063. *adustus* Le Conte.
 1064. *testaceus* Fabricius.
 1065. *punctatus* Le Conte.
 1066. *angustulus* Le Conte.
 1067. *scharzei* Casey.
 1068. *alternans* Erichson.
 1069. *pusillus* Schönherr.
 1070. *Lathropus vernalis* Le Conte.
 1071. *Dysmerus basalis* Casey.
 1072. *Brontes dubius* Fabricius.
 1073. *debilis* Le Conte.
 1074. *Telephanus relax* Haldeman.

CRYPTOPHAGIDÆ.

1075. *Telmatoophilus americanus* Le Conte.
 1076. *Lobus impressus* Le Conte.
 1077. *Tomarus pulchellus* Le Conte.
 1078. *Antherophagus ochraceus* Melsheimer.
 1079. *Henoticus serratus* Gyllenhal.
 1080. *Cryptophagus*¹ *cellaris* Scopuli.
 1081. *difficilis* Le Conte.
 1082. *plectrum* Casey.

¹And several unnamed species.

LIST OF SPECIES—Continued.

- | | |
|---|---|
| 1083. <i>Cryptophagus</i> <i>croceus</i> Zimmermann. | 1122. <i>Anthrenus</i> <i>scrophularia</i> Linnaeus. |
| 1084. <i>fungicola</i> Zimmermann. | 1123. <i>verbasci</i> Linnaeus. |
| 1085. <i>cruentus</i> Zimmermann. | 1124. <i>muscorum</i> Linnaeus. |
| 1086. <i>nodungulus</i> Zimmermann. | 1125. <i>Cryptorhopalum</i> <i>haemorrhoidale</i> Le Conte. |
| 1087. <i>Ctenoscelis</i> ¹ <i>ferrugineus</i> Sahlberg(?). | 1126. <i>triste</i> Le Conte. |
| 1088. <i>testaceus</i> Zimmermann. | 1127. <i>Ipsectus</i> <i>hispidus</i> Melsheimer. |
| 1089. <i>Atomaria</i> ¹ <i>ephippiata</i> Zimmermann. | 1128. <i>Orphilus</i> <i>niger</i> Rossi. |
| 1090. <i>ochracea</i> Zimmermann. | |
| 1091. <i>distincta</i> Casey. | |
| 1092. <i>Ephistemus</i> <i>apicalis</i> Le Conte. | |
| MYCETOPHAGID.E. | |
| 1093. <i>Mycetophagus</i> <i>punctatus</i> Say. | 1129. <i>Hololepta</i> <i>lucida</i> Le Conte. |
| 1094. <i>flexuosus</i> Say. | 1130. <i>fossularis</i> Say. |
| 1095. <i>bipustulatus</i> Melsheimer. | 1131. <i>Hister</i> <i>biplagiatus</i> Le Conte. |
| 1096. <i>melsheimeri</i> Le Conte. | 1132. <i>laevipes</i> Germar. |
| 1097. <i>pluripunctatus</i> Le Conte. | 1133. <i>harrisii</i> Kirby. |
| 1098. <i>pini</i> Ziegler. | 1134. <i>merdarius</i> Hoffmann. |
| 1099. <i>obsoletus</i> Melsheimer. | 1135. <i>interruptus</i> Beauvois. |
| 1100. <i>Litargus</i> <i>tetraspilotus</i> Le Conte. | 1136. <i>immunis</i> Erichson. |
| 1101. <i>6-punctatus</i> Say. | 1137. <i>marginicollis</i> Le Conte. |
| 1102. <i>balleatus</i> Le Conte. | 1138. <i>cognatus</i> Le Conte. |
| 1103. <i>didesmus</i> Say. | 1139. <i>fedatus</i> Le Conte. |
| 1104. <i>nebulosus</i> Le Conte. | 1140. <i>abbreviatus</i> Fabricius. |
| 1105. <i>Typhius</i> <i>funata</i> Linnaeus. | 1141. <i>civilis</i> Le Conte. |
| 1106. <i>Bergius</i> <i>pumilus</i> Le Conte. | 1142. <i>depurator</i> Say. |
| 1107. <i>Myrmecivorus</i> <i>luthridioides</i> Crotch. | 1143. <i>curtatus</i> Le Conte. |
| 1108. <i>Diplocephus</i> <i>brunneus</i> Le Conte. | 1144. <i>indistinctus</i> Say. |
| 1109. <i>rudis</i> Le Conte. | 1145. <i>bimaculatus</i> Linnaeus. |
| | 1146. <i>16-striatus</i> Say. |
| | 1147. <i>americanus</i> Paykull. |
| | 1148. <i>Phelister</i> <i>tenebrionicus</i> Horn. |
| | 1149. <i>subrotundus</i> Say. |
| | 1150. <i>vernus</i> Say. |
| | 1151. <i>Platysoma</i> <i>carolinum</i> Paykull. |
| | 1152. <i>lecontei</i> Marseul. |
| | 1153. <i>aurelianum</i> Horn. |
| | 1154. <i>parallelum</i> Say. |
| | 1155. <i>coarctatum</i> Le Conte. |
| | 1156. <i>Cylindrix</i> <i>cylindricus</i> Paykull. |
| | 1157. <i>attenuatus</i> Le Conte. |
| | 1158. <i>Tribalister</i> <i>marginellus</i> Le Conte. |
| | 1159. <i>Tribalus</i> <i>americanus</i> Le Conte. |
| | 1160. <i>Epierus</i> <i>regularis</i> Beauvois. |
| | 1161. <i>pulicarius</i> Erichson. |
| | 1162. <i>Heterius</i> <i>brunnipennis</i> Randall. |
| | 1163. <i>Echinodes</i> <i>setiger</i> Le Conte. |
| | 1164. <i>Orthophilus</i> <i>alternatus</i> Say. |
| | 1165. <i>Dendrophilus</i> <i>punctulatus</i> Say. |
| | 1166. <i>Paronachus</i> <i>aqualis</i> Say. |
| | 1167. <i>bistriatus</i> Erichson. |
| | 1168. <i>seminuluna</i> Erichson. |
| | 1169. <i>teres</i> Le Conte. |
| DERMESTID.E. | |
| 1110. <i>Byturus</i> <i>unicolor</i> Say. | |
| 1111. <i>Dermestes</i> <i>caninus</i> Germar. | |
| 1112. <i>lardarius</i> Linnaeus. | |
| 1113. <i>elongatus</i> Le Conte. | |
| 1114. <i>uliginosus</i> Fabricius. | |
| 1115. <i>frischii</i> Kugelann. | |
| 1116. <i>Attagenus</i> <i>pellio</i> Linnaeus. | |
| 1117. <i>hornii</i> Jayne. | |
| 1118. <i>piceus</i> Olivier. | |
| 1119. <i>Trogoderma</i> <i>ornatum</i> Say. | |
| 1120. <i>sternale</i> Jayne. | |
| 1121. <i>tarsale</i> Melsheimer. | |

¹And several unnamed species.

LIST OF SPECIES—Continued.

1170. *Carcinops conjunctus* Say.
 1171. *geminatus* Le Conte.
 1172. *14-striatus* Stephens.
 1173. *Anapleus marginatus* Le Conte.
 1174. *Saprinus rotundatus* Kugelann.
 1175. *pennsylvanicus* Paykull.
 1176. *impressus* Le Conte.
 1177. *assimilis* Paykull.
 1178. *conformis* Le Conte.
 1179. *placidus* Erichson.
 1180. *fraternus* Say.
 1181. *fitchii* Marseul.
 1182. *patruelis* Le Conte.
 1183. *sphaeroides* Le Conte.
 1184. *Plegaderus transversus* Say.
 1185. *Teretrius americanus* Le Conte.
 1186. *Bacanius tantillus* Le Conte.
 1187. *punctiformis* Marseul.
 1188. *Acrithus eriguus* Erichson.
 1189. *discus* Le Conte.
 1190. *fimetiarius* Le Conte.
 1191. *strigosus* Le Conte.
 1192. *politus* Le Conte.
 1193. *simplex* Le Conte.

NITIDULIDÆ.

1194. *Brachypterus urticæ* Fabricius.
 1195. *Cercus abdominalis* Erichson.
 1196. *pennatus* Murray.
 1197. *Carpophilus hemipterus* Linnaeus.
 1198. *dimidiatus* Fabricius.
 1199. *niger* Say.
 1200. *marginatus* Erichson.
 1201. *corticinus* Erichson.
 1202. *brachypterus* Say.
 1203. *antiquus* Melsheimer.
 1204. *Colastes morio* Erichson.
 1205. *maculatus* Erichson.
 1206. *semitectus* Say.
 1207. *unicolor* Say.
 1208. *truncatus* Randall.
 1209. *Oncotus obscurus* Erichson.
 1210. *mericanus* Murray.
 1211. *Hypura helicta* Erichson.
 1212. *rufa* Say.
 1213. *erichsoni* Reitter.
 1214. *rufi* Melsheimer.
 1215. *prictus* Erichson.
 1216. *helictus* Horn.
 1217. *obscurus* Erichson.
1218. *Epuræi peltoides* Horn.
 1219. *labilis* Erichson.
 1220. *obtusicollis* Reitter.
 1221. *Nitidula bipunctata* Linnaeus.
 1222. *rufipes* Linnaeus.
 1223. *ziczac* Say.
 1224. *Stelidota geminata* Say.
 1225. *8-maculata* Say.
 1226. *strigosa* Gyllenhal.
 1227. *Prometopia 6-maculata* Say.
 1228. *Phenolia grossa* Fabricius.
 1229. *Omosita colon* Linnaeus.
 1230. *Amphotis ulkei* Le Conte.
 1231. *Soronia undulata* Say.
 1232. *substriata* Hamilton.
 1233. *Thalycra concolor* Le Conte.
 1234. *Pocadius helvohus* Erichson.
 1235. *Oxyenemus histrius* Le Conte.
 1236. *nigripennis* Le Conte.
 1237. *Amphicrossus ciliatus* Olivier.
 1238. *Pallodes pallidus* Beauvois.
 1239. *Cyclranus adustus* Erichson.
 1240. *var. bicolor* Horn.
 1241. *Cybocephalus nigrifrons* Le Conte.
 1242. *Cryptarcha ampla* Erichson.
 1243. *strigata* Fabricius.
 1244. *concinna* Melsheimer.
 1245. *Ips obtusus* Say.
 1246. *quadriguttatus* Fabricius.
 1247. *confluentus* Say.
 1248. *sanguinolentus* Olivier.
 1249. *Pityophagus cephalotes* Le Conte.
 1250. *Rhizophagus cylindricus* Le Conte.
 1251. *bipunctatus* Say.

LATHRIDIDÆ.

1252. *Huloparanecus kunzei* Aubé.
 1253. *Lathridius viratus* Le Conte.
 1254. *Coninomus constrictus* Gyllenhal.
 1255. *nodifer* Westwood.
 1256. *Enicmus minutus* Linnaeus.
 1257. *aterrimus* Motschulsky.
 1258. *Curtodere elegans* Aubé.
 1259. *filiformis* Gyllenhal.
 1260. *Alisteria watsoni* Wollaston.
 1261. *Corticaria pubescens* Gyllenhal.
 1262. *dentigera* Le Conte.
 1263. *ferruginea* Gyllenhal.
 1264. *serrata* Paykull.
 1265. *elongata* Gyllenhal.

LIST OF SPECIES—Continued.

1266. *Melanophthalma*¹ *longipennis* Le Conte.
 1267. *americana* Mannerheim.
 1268. *curvicolis* Mannerheim.
 1269. *gibbosa* Herbst.
 1270. *distinguenda* Comoli.
 1271. *picta* Le Conte.
 1272. *simpler* Le Conte.
- TROGOSITIDÆ.**
1273. *Nemotoma parallelum* Melsheimer.
 1274. *cylindricum* Le Conte.
 1275. *Alndria cylindrica* Serville.
 1276. *terre* Melsheimer.
 1277. *Trogosita virescens* Fabricius.
 1278. *Tenebrioides mauritanica* Linnaeus.
 1279. *corticalis* Melsheimer.
 1280. *nana* Melsheimer.
 1281. *marginata* Beauvois.
 1282. var. *cucujiformis* Horn.
 1283. *americana* Kirby.
 1284. var. *laticollis* Horn.
 1285. *rugosipennis* Horn.
 1286. *bimaculata* Melsheimer.
 1287. *obtusa* Horn.
 1288. *Grynochuris 4-lineata* Melsheimer.
 1289. *Lycophus villosus* Casey.
 1290. *Thymalus fulgidus* Erichson.
- MONOTOMIDÆ.**
1291. *Monotoma picipes* Herbst.
 1292. *americana* Aubé.
 1293. *4-foveolata* Aubé.
 1294. *parallela* Le Conte.
 1295. *longicollis* Gyllenhal.
 1296. *Hesperobarnus rufipes* Le Conte.
 1297. *Europs pallipennis* Le Conte.
 1298. *Bactridium cphippigerum* Guérin.
 1299. *striolatum* Reitter.
 1300. *curvicolle* Horn.
- BYRRHIDÆ.**
1301. *Nosodendron unicolor* Say.
 1302. *Byrrhus nutrinus* Fabricius.
 1303. *Symplegma strigosus* Melsheimer.
1304. *Limnichus olivaceus* Le Conte.
 1305. *punctatus* Le Conte.
 1306. *nebulosus* Le Conte.
 1307. *ater* Le Conte.
 1308. *Lutrochus* Le Conte.
 1309. *ovatus* Le Conte.
- PARNIDÆ.**
1310. *Psephenus lecontei* Le Conte.
 1311. *Lutrochus luteus* Le Conte.
 1312. *Dryops lithophilus* Germar.
 1313. *fastigiatus* Say.
 1314. *Elmus 4-notatus* Say.
 1315. *fastidius* Le Conte.
 1316. *ovalis* Le Conte.
 1317. *nitidulus* Le Conte.
 1318. *laticollis* Le Conte.
 1319. *pumilus* Le Conte.
 1320. *Stenelmis linearis* Zimmerman.
 1321. *sinuatus* Le Conte.
 1322. *crenatus* Say.
 1323. *quadrimaculatus* Horn.
 1324. *Macronychus glabratus* Say.
 1325. *Ancyronyx variegatus* Germar.
- HETEROCERIDÆ.**
1326. *Heterocerus ventralis* Melsheimer.
 1327. *brunneus* Melsheimer.
 1328. *collaris* Kiesenwetter.
 1329. *pusillus* Say.
- DASYLLIDÆ.**
1330. *Eurygogon niger* Melsheimer.
 1331. *californicus* Horn.
 1332. *Onchomys trivittis* Germar.
 1333. *Anchytarsus bicolor* Melsheimer.
 1334. *Ptilodactyla serricollis* Say.
 1335. *Eucinetus punctulatus* Le Conte.
 1336. *morio* Le Conte.
 1337. *strigosus* Le Conte.
 1338. *Ectopria nervosa* Melsheimer.
 1339. var. *thoracica* Ziegler.
 1340. *Prionocephon discoidens* Say.
 1341. *limbatus* Le Conte.
 1342. *Helodes pulchellus* Guérin.
 1343. *fuscipennis* Guérin.
 1344. *thoracica* Guérin.
 1345. *Strytes tibialis* Guérin.
 1346. *Cyphon robustus* Le Conte.

LIST OF SPECIES—Continued.

1347. *Cyphon obscurus* Guérin.
 1348. *variabilis* Thunberg.
 1349. *collaris* Guérin.
 1350. *ruficollis* Say.
 RHIPICERIDÆ.
 1351. *Zenon picea* Beauvois.
 1352. *Sandalus niger* Knoch.
 1353. *petrophysa* Knoch.
 ELATERIDÆ.
 1354. *Melasis pectinicornis* Melsheimer.
 1355. *Tharops ruficornis* Say.
 1356. *Stethus pectorosus* Le Conte.
 1357. *Deltometopus antennicornis* Say.
 1358. *rufipes* Melsheimer.
 1359. *Dromaeolus striatus* Le Conte.
 1360. *cylindricollis* Say.
 1361. *Forane badius* Melsheimer.
 1362. *calceatus* Say.
 1363. *hornii* Bonvouloir.
 1364. *Adelothyrus dejeanii* Bonvouloir.
 1365. *Microthagus humeralis* Say.
 1366. *pectinatus* Le Conte.
 1367. *bonvouloiri* Horn.
 1368. *audar* Horn.
 1369. *subsinuatus* Le Conte
 1370. *triangularis* Say.
 1371. *Hypocatus frontosus* Say.
 1372. *terminalis* Le Conte.
 1373. *Nematodes atropus* Say.
 1374. *Adelocera impressicollis* Say.
 1375. *marmorata* Fabricius.
 1376. *discoidea* Weber.
 1377. *maculata* Le Conte.
 1378. *avita* Say.
 1379. *Meristhus scabinula* Candèze.
 1380. *Chalcolepidius virilipilis* Le Conte.
 1381. *Alaus oculatus* Linnaeus.
 1382. *myops* Fabricius.
 1383. *Hemirhynchus fascicularis* Fabricius.
 1384. *Cardiophorus convexus* Say.
 1385. *cardiace* Say.
 1386. *gagates* Erichson.
 1387. *Horistonotus curvatus* Say.
 1388. *Ecthesopus clavicollis* Say.
 1389. *Cryptohypnus choris* Say.
 1390. *melsheimeri* Horn.
 1391. *pectoralis* Say.
 1392. *var. inops* Say.
 1393. *obliquatus* Melsheimer.
 1394. *Cryptohypnus perpleurus* Horn.
 1395. *Anchastus rufus* Candèze.
 1396. *Monocrepidius lividus* De Geer.
 1397. *suturalis* Le Conte
 1398. *respertinus* Fabricius.
 1399. *auritus* Herbst.
 1400. *bellus* Say.
 1401. *Dicrepidius ramicornis* Beauvois.
 1402. *Ischiodontus solcatus* Say.
 1403. *Elater hepaticus* Melsheimer.
 1404. *municipalis* Candèze.
 1405. *pedalis* Germar.
 1406. *miatus* Herbst.
 1407. *nigricollis* Herbst.
 1408. *livens* Say.
 1409. *discoidea* Fabricius.
 1410. *sagii* Le Conte.
 1411. *impositus* Melsheimer.
 1412. *socer* Le Conte.
 1413. *rubricollis* Herbst.
 1414. *semicinctus* Randall.
 1415. *nigricans* Germar.
 1416. *rubricus* Say.
 1417. *collaris* Say.
 1418. *var. palens* Le Conte.
 1419. *sanguinipennis* Say.
 1420. *randhomus* Germar.
 1421. *obliquus* Say.
 1422. *pulsio* Germar.
 1423. *Drasterius elegans* Fabricius.
 1424. *unabilis* Le Conte.
 1425. *Megapenthes rufilabris* Germar.
 1426. *limbalis* Herbst.
 1427. *Ludius attenuatus* Say.
 1428. *abruptus* Say.
 1429. *Agrilus aridus* Le Conte.
 1430. *pubescens* Melsheimer.
 1431. *inscans* Candèze.
 1432. *oblongicollis* Melsheimer.
 1433. *Dolopius lateralis* Eschscholtz.
 1434. *Betarmon bigeminatus* Randall.
 1435. *Glyphonyx ruficollis* Say.
 1436. *testaceus* Melsheimer.
 1437. *Melanotus depressus* Melsheimer.
 1438. *clandestinus* Erichson.
 1439. *cananipes* Paykull.
 1440. *sagittarius* Le Conte.
 1441. *flexilis* Say.
 1442. *communis* Gyllenhal.
 1443. *infaustus* Le Conte.
 1444. *tenax* Say.
 1445. *americanus* Herbst.

LIST OF SPECIES—Continued.

1446. *Melanotus pertinax* Say.
 1447. *usipiens* Say.
 1448. *Lamomus auripilis* Say.
 1449. *aurifer* Le Conte
 1450. *stigma* Herbst.
 1451. *griseus* Beauvois.
 1452. *confusus* Le Conte.
 1453. *plebeus* Say.
 1454. *quercinus* Say.
 1455. *agnus* Say.
 1456. *ornatipennis* Le Conte.
 1457. *definitus* Ziegler.
 1458. *nimbatus* Say.
 1459. *basillarius* Say.
 1460. *Athous brightwelli* Kirby.
 1461. *acanthus* Say.
 1462. *encaillatus* Say.
 1463. *sculpturatus* Say.
 1464. *posticus* Melsheimer.
 1465. *Leptoscapha bicolor* Le Conte.
 1466. *Sericosomus viridanus* Say
 1467. *silvaceus* Say.
 1468. *Corymbites tessellatus* Linnaeus
 1469. *cylindricornis* Herbst.
 1470. *pyrrhus* Herbst.
 1471. *turmidis* Melsheimer.
 1472. *æthiops* Herbst.
 1473. *hamatus* Say.
 1474. *splendens* Ziegler.
 1475. *inflatus* Say.
 1476. *rotundicollis* Say.
 1477. *Hemicrepidius mamonius* Herbst.
 1478. *bilobatus* Say.
 1479. *discoloratus* Say.
 1480. *Melanactes piceus* De Geer.
 1481. *morio* Fabricius.
 1482. *reichei* Germar.
 1483. *Peronthops mucida* Gyllenhal.
 1484. *Cerophytum pulsator* Haldeman.
 1493. *Dicerea duraricata* Say.
 1494. var. *caudata* Le Conte.
 1495. *pugionata* Germar.
 1496. *obscura* Fabricius.
 1497. var. *lurida* Fabricius.
 1498. *lepida* Le Conte.
 1499. *specta* Gory.
 1500. *asperata* Laporte.
 1501. *punctulata* Schonherr.
 1502. *Pachynota debilis* Le Conte
 1503. *Buprestis rufipes* Olivier.
 1504. *lineata* Fabricius
 1505. *strata* Fabricius.
 1506. *decora* Fabricius.
 1507. *Cingra gracilipes* Melsheimer
 1508. *Melanophila notata* Laporte.
 1509. *acuminata* De Geer.
 1510. *nitida* Melsheimer.
 1511. *Anthrenus viridifrons* Laporte
 1512. *viridicornis* Say.
 1513. *cygnella* Gory.
 1514. *querata* Fabricius.
 1515. *flavimana* Gory.
 1516. *Chrysobothris femorata* Fabricius
 1517. *floricola* Gory.
 1518. *dentipes* Germar.
 1519. *blanchardi* Horn.
 1520. *pusilla* Laporte.
 1521. *6-signata* Say.
 1522. *azurea* Le Conte.
 1523. *scitula* Gory.
 1524. *harvisti* Hentz.
 1525. *Actenodes acornis* Say.
 1526. *Actenodera ornata* Fabricius.
 1527. *culta* Weber.
 1528. *Ptosima gibbicollis* Say.
 1529. *Mastogenius subgenuus* Le Conte.
 1530. *Eupristocerus cogitans* Weber.
 1531. *Agrilus ruficollis* Fabricius.
 1532. *otiosus* Say.
 1533. *arcuatus* Say.
 1534. *bilineatus* Weber.
 1535. *granulatus* Say.
 1536. *politus* Say.
 1537. *fuller* Say.
 1538. *obsoletoguttatus* Gory.
 1539. *subcinctus* Gory.
 1540. *lecontei* Saunders.
 1541. *egens* Gory.
 1542. *Rhuborellis tenuis* Le Conte.
 1543. *Taphrocercus gracilis* Say.
 1544. *Brachys orata* Weber.

THROSCIDÆ.

1485. *Drapetes geminatus* Say.
 1486. *Antonothroscus constrictor* Say.
 1487. *Throscus punctatus* Bonvouloir.
 1488. *chevrolatii* Bonvouloir.
 1489. *convergens* Horn.
 1490. *pugnax* Horn.

BUPRESTIDÆ.

1491. *Chalcophora virginiana* Drury.
 1492. *campestris* Say.

LIST OF SPECIES—Continued.

1545. *Brachys arosa* Melsheimer.
 1546. *virginosa* Gory.
 1547. *Pachyscelus purpureus* Say.
 1548. *lveigatus* Say.

LAMPYRIDÆ.

1549. *Calopteron terminale* Say.
 1550. *reticulatum* Fabricius.
 1551. *Celetes basalis* Le Conte.
 1552. *Crenia dimidiata* Fabricius.
 1553. *Eros thoracicus* Randall.
 1554. *aurorea* Herbst.
 1555. *mundus* Say.
 1556. *sculptilis* Say.
 1557. *trilineatus* Melsheimer.
 1558. *Platycorax timidus* Le Conte.
 1559. *modestus* Say.
 1560. *canaliculatus* Say.
 1561. *lietor* Newnan.
 1562. *floralis* Melsheimer.
 1563. *Calochromus persimilis* Say.
 1564. *Lucidota atra* Fabricius.
 1565. *pinetata* Le Conte.
 1566. *Ellychnia corrusca* Linnaeus.
 1567. *Pyropyga nigriceps* Say.
 1568. *decipiens* Harris.
 1569. *minuta* Le Conte.
 1570. *Pyroctomena angulata* Say.
 1571. *luciferi* Melsheimer.
 1572. *Photinus consanguineus* Le Conte.
 1573. *pyralis* Linnaeus.
 1574. *scintillans* Say.
 1575. *Photuris pennsylvanica* De Geer.
 1576. *Phengodes*.¹
 1577. *Typhthonyx erythrocephala* Fabricius.
 1578. *Omethes marginatus* Le Conte.
 1579. *Chauliognathus pennsylvanicus* De Geer.
 1580. *marginatus* Fabricius.
 1581. *Podabrus tricosatus* Say.
 1582. *rugosulus* Le Conte.
 1583. *frater* Le Conte.
 1584. *basilaris* Say.
 1585. *monticola* Say.
 1586. *brunneicollis* Le Conte.
 1587. *serpens* Say.
 1588. *scutellata* Le Conte.
 1589. *Diaperis bilobatus* Say.
 1590. *Diaperis curvatus* Le Conte.
 1591. *lecontei* Le Conte.

1592. *Telephorus fraxini* Say.
 1593. *carolinus* Fabricius.
 1594. *lincoln* Fabricius.
 1595. *costipennis* Le Conte.
 1596. *rectus* Melsheimer.
 1597. *scitulus* Say.
 1598. *pusillus* Le Conte.
 1599. *longulus* Le Conte.
 1600. *rotundicollis* Say.
 1601. *tuberculatus* Le Conte.
 1602. *bilineatus* Say.
 1603. *marginellus* Le Conte.
 1604. *Polemnius laticornis* Say.
 1605. *Trypherus latipennis* Germar.
 1606. *Malthinus occipitalis* Le Conte.
 1607. *Malthodes spado* Le Conte.
 1608. *concurus* Le Conte.
 1609. *rectus* Le Conte.
 1610. *arcifer* Le Conte.
 1611. *euphorus* Le Conte.
 1612. *parvulus* Le Conte.

MALACITIDÆ.

1613. *Collops tricolor* Say.
 1614. *eximius* Erichson.
 1615. *nigriceps* Say.
 1616. *4-nuculatus* Fabricius.
 1617. *nitatus* Say.
 1618. *Chetocetus setosus* Le Conte.
 1619. *Anthoromus flavilabris* Say.
 1620. *Pseudobius apicalis* Say.
 1621. *oblitus* Le Conte.
 1622. *bicolor* Le Conte.
 1623. *Attalus terminalis* Erichson.
 1624. *granularis* Erichson.
 1625. *morulus* Le Conte.
 1626. *pullifrons* Motschulsky.
 1627. *melanopterus* Erichson.
 1628. *otiosus* Say.
 1629. *circumscripatus* Say.
 1630. *scincetus* Say.

MELYRIDÆ.

1631. *Allymeris cribrata* Le Conte.

CLERIDÆ.

1632. *Elaenocerus terminatus* Say.
 1633. *Cymatodera brunnea* Melsheimer.
 1634. *inornata* Say.
 1635. *undulata* Say.

¹ Unknown species, female.

LIST OF SPECIES—Continued.

1636. *Trichodes apivorus* Germar.
 1637. *Clerus quadriguttatus* Olivier.
 1638. *var. nigripennis* Say.
 1639. *rosmarius* Say.
 1640. *ichneumonens* Fabricius.
 1641. *thoracicus* Olivier.
 1642. *Thanosinus dubius* Fabricius.
 1643. *Thanaoclerus sanguineus* Say.
 1644. *tantillus* Le Conte.
 1645. *Hydrocerus unifasciatus* Say.
 1646. *humeralis* Say.
 1647. *pallipennis* Say.
 1648. *verticillus* Say.
 1649. *tubida* Le Conte.
 1650. *longicollis* Ziegler.
 1651. *Phyllobaeus discodatus* Say.
 1652. *Ichneumon laticornis* Say.
 1653. *Chrysomela pilosa* Say.
 1654. *var. onusta* Say.
 1655. *Creggia retusta* Spinola.
 1656. *oculata* Say.
 1657. *mirta* Le Conte.
 1658. *Orthopleura damicornis* Fabricius.
 1659. *texana* Bland.
 1660. *Nerodia rufipes* Fabricius.
 1661. *ruficollis* Fabricius.
 1662. *violacea* Linnaeus.

DERODONTIDÆ.

1663. *Derodontus maculatus* Melsheimer.
 1664. *Laricobius erichsoni* Rosenhauer.

PTINIDÆ.

1665. *Gibbium psyllioides* Czenpinski.
 1666. *Plinus fur* Linnaeus.
 1667. *brunneus* Duftschmid.
 1668. *quadrinaculatus* Melsheimer.
 1669. *interruptus* Le Conte.
 1670. *Eucrada humeralis* Melsheimer.
 1671. *Ernobius mollis* Fabricius.
 1672. *luteipennis* Le Conte.
 1673. *filicornis* Le Conte.
 1674. *granulatus* Le Conte.
 1675. *Ozognathus floridanus* Le Conte.
 1676. *Oligomerus sericans* Melsheimer.
 1677. *alternatus* Le Conte.
 1678. *obtus* Le Conte.
 1679. *Sitodrepa panicea* Linnaeus.
 1680. *Hadrobregmus errans* Melsheimer.
 1681. *carinatus* Say.
 1682. *Trichodesma gibbosa* Say.
 1683. *Anobium notatum* Say.

1684. *Trypophytus sericeus* Say.
 1685. *Petalium histriatum* Say.
 1686. *Theca profunda* Le Conte.
 1687. *Eupactus nitidus* Le Conte.
 1688. *Xyletinus peltatus* Harris.
 1689. *Lasioderma serripenne* Fabricius.
 1690. *Hemipterus punctatus* Le Conte.
 1691. *gravis* Le Conte.
 1692. *ventralis* Le Conte.
 1693. *nigritulus* Le Conte.
 1694. *Protheca hispida* Le Conte.
 1695. *puberula* Le Conte.
 1696. *Dorcatoma setulosum* Le Conte.
 1697. *incomptum* Le Conte.
 1698. *pallidum* Le Conte.
 1699. *Ctenocara oculata* Say.
 1700. *intermedia* Le Conte.
 1701. *Ptilinus ruficornis* Say.
 1702. *Endecatomus rugosus* Randall.

BOSTRICHIDÆ.

1703. *Dinoderus minutus* Fabricius.
 1704. *Rhizophora dominica* Fabricius.
 1705. *Stephanopachys crinitus* Le Conte.
 1706. *densus* Le Conte.
 1707. *rugosus* Olivier.
 1708. *Prostephanus punctatus* Le Conte.
 1709. *Lichenophanes truncatellus* Le Conte.
 1710. *armiger* Le Conte.
 1711. *bicornis* Weber.
 1712. *Schistocerus humatus* Fabricius.
 1713. *Micrapate dinoderoides* Horn.
 1714. *cristicauda* Casey.
 1715. *Xylobius basilaris* Say.
 1716. *texana* Horn.
 1717. *Scobicia bidentata* Horn.

LYCTIDÆ.

1718. *Lyctus striatus* Melsheimer.
 1719. *opaculus* Le Conte.
 1720. *plumicollis* Le Conte.
 1721. *Trogosylon parallelopedum* Melsheimer.

CUPESIDÆ.

1722. *Cupes concolor* Westwood.

LYMEXYLIDÆ.

1723. *Lymexylon sericeum* Harris.
 1724. *Micromalthus debilis* Le Conte.

LIST OF SPECIES—Continued.

CISIDÆ.

1725. *Cis fuscipes* Mellié.
 1726. *creberrimus* Mellié.
 1727. *Brachycis brevicollis* Casey.
 1728. *Orthocis punctatus* Mellié.
 1729. *Ennearthron thoracicornis* Ziegler.
 1730. *Cerucis sallei* Mellié.
 1731. *Rhipidandrus paradoxus* Beauvois.

SPHINDIDÆ.

1732. *Sphindus americanus* Le Conte.

LUCANIDÆ.

1733. *Lucanus elaphus* Fabricius.
 1734. *damus* Thunberg.
 1735. *Dorcus parallelus* Say.
 1736. *Platycerus quercus* Weber.
 1737. *Ceruchus piceus* Weber.
 1738. *Nicagus obscurus* Le Conte.

PASSALIDÆ.

1739. *Passalus cornutus* Fabricius.

SCARABÆIDÆ.

1740. *Cunthon laevis* Drury.
 1741. *nigilans* Le Conte.
 1742. *viridis* Beauvois.
 1743. *Charididum histerrundes* Weber.
 1744. *Copris carolina* Linnaeus.
 1745. *anaglyptica* Say.
 1746. *minuta* Drury.
 1747. *Phanæus carnifex* Linnaeus.
 1748. *Onthophagus hecate* Panzer.
 1749. *janus* Panzer.
 1750. var. *orpheus* Panzer
 1751. var. *striatulus* Beauvois.
 1752. *tuberculifrons* Harold.
 1753. *pennsylvanicus* Harold.
 1754. *Aphodius fimetarius* Linnaeus.
 1755. *ruricola* Melsheimer.
 1756. *granarius* Linnaeus.
 1757. *vittatus* Say.
 1758. *lucidus* Olivier.
 1759. *serici* Say.
 1760. *inquinatus* Herbst.
 1761. *leopardus* Horn.
 1762. *relictus* Beauvois.
 1763. *sericeus* Melsheimer.

1764. *Aphodius terminalis* Say.
 1765. *bicolor* Say.
 1766. *femoralis* Say.
 1767. *oblongus* Say.
 1768. *Dialytus truncatus* Melsheimer.
 1769. *striatulus* Say.
 1770. *Atrinius cylindrus* Horn.
 1771. *abditus* Haldeman.
 1772. *lecontei* Harold.
 1773. *texanus* Harold.
 1774. *laxiventris* Horn.
 1775. *imbricatus* Melsheimer.
 1776. *socius* Horn.
 1777. *oratus* Horn.
 1778. *gracilis* Melsheimer.
 1779. *figurator* Harold.
 1780. *strigatus* Say.
 1781. *cognatus* Le Conte.
 1782. *Rhyssalus scaber* Haldeman.
 1783. *Pleurophorus caryus* Panzer.
 1784. *ventralis* Horn.
 1785. *Psammophilus regalis* Haldeman.
 1786. *interruptus* Say.
 1787. *Egialia* new species.
 1788. *Ochodax musculus* Say.
 1789. *Bolbocerus furetus* Fabricius.
 1790. *lazarus* Fabricius.
 1791. *Odontæus cornigerus* Melsheimer.
 1792. *Geotrupes splendidus* Fabricius.
 1793. *balyi* Jekel.
 1794. *semioparus* Jekel.
 1795. *blackburnii* Fabricius.
 1796. *egeriei* Germar.
 1797. *hornii* Blanchard.
 1798. *Cleotus aphrodisioides* Illiger.
 1799. *Trox monachus* Herbst.
 1800. *asper* Le Conte.
 1801. *suberosus* Fabricius.
 1802. *tuberculatus* De Geer.
 1803. *erinaceus* Le Conte.
 1804. *capillaris* Say.
 1805. *foreicollis* Harold.
 1806. *terrestris* Say.
 1807. *scaber* Linnaeus.
 1808. *Hoplia trivialis* Harold.
 1809. *mucorea* Germar.
 1810. *modesta* Haldeman.
 1811. *Dichelomycha elongata* Fabricius.
 1812. *fuscula* Le Conte.
 1813. *Serica vespertina* Gyllenhal.
 1814. *iricolor* Say.
 1815. *sericea* Illiger.

LIST OF SPECIES—Continued.

1816. *Serica trociformis* Burmeister.
 1817. *Macroductylus subspinosus* Fabricius.
 1818. *angustatus* Beauvois.
 1819. *Diplotaxis sordida* Say.
 1820. *liberta* Germar.
 1821. *tristis* Kirby.
 1822. *harperi* Blanchard.
 1823. *Lachnosterna prununculina* Burmeister.
 1824. *ephilida* Say.
 1825. *glaberrima* Blanchard.
 1826. *gracilis* Burmeister.
 1827. *gibbosa* Burmeister.
 1828. *congrua* Le Conte.
 1829. *inversa* Horn.
 1830. *micans* Knoch.
 1831. *fusca* Frohlich.
 1832. *arvata* Smith.
 1833. *grandis* Smith.
 1834. *dubia* Smith.
 1835. *hornii* Smith.
 1836. *marginalis* Le Conte.
 1837. *fraterna* Harris.
 1838. *nova* Smith.
 1839. *luctuosa* Horn.
 1840. *knocchii* Gyllenhal.
 1841. *profunda* Blanchard.
 1842. *balia* Say.
 1843. *hirsuta* Knoch.
 1844. *ilicis* Knoch.
 1845. *hirticula* Knoch.
 1846. *parvidens* Le Conte.
 1847. *quercus* Knoch.
 1848. *tristis* Fabricius.
 1849. *Anomala marginata* Fabricius.
 1850. *binotata* Gyllenhal.
 1851. *undulata* Melsheimer.
 1852. *minuta* Burmeister.
 1853. *lucicola* Fabricius.
 1854. *Strigoderma arboricola* Fabricius.
 1855. *pygmaeum* Fabricius.
 1856. *Pelidnota punctata* Linnaeus.
 1857. *Cotalpa lanigera* Linnaeus.
 1858. *Cyclocephala immaculata* Burmeister.
 1859. *villosa* Burmeister.
 1860. *Chalepus trachypygus* Burmeister.
 1861. *Ligyris gibbosus* De Geer.
 1862. *relictus* Say.
 1863. *Aphonus trideniatus* Say.
 1864. *castaneus* Melsheimer.
 1865. *Xyloryctes satyrus* Fabricius.
 1866. *Strategus anteus* Fabricius.
 1867. *Dynastes tityus* Linnaeus.
 1868. *Phileurus valgus* Fabricius.
 1869. *Allorhina nitida* Linnaeus.
 1870. *Euphorus areata* Fabricius.
 1871. *sepulchralis* Fabricius.
 1872. *fulgida* Fabricius.
 1873. *herbarea* Olivier.
 1874. *inda* Linnaeus.
 1875. *Cremastochilus leucostictus* Burmeister.
 1876. *variolosus* Kirby.
 1877. *canaliculatus* Kirby.
 1878. *castaneae* Knoch.
 1879. *harrisii* Kirby.
 1880. *Osmoderma eremicola* Knoch.
 1881. *scabrum* Beauvois.
 1882. *Gnorimus maculosus* Knoch.
 1883. *Trichus piger* Fabricius.
 1884. *affinis* Gory.
 1885. *bibens* Fabricius.
 1886. *viridulus* Fabricius.
 1887. *Vulgus canaliculatus* Fabricius.
 1888. *squamiger* Beauvois.
- SPONDYLIDÆ.**
1889. *Parandra brunnea* Fabricius.
- CERAMBYCIDÆ.**
1890. *Orthosoma brunneum* Forster.
 1891. *Prionus laticollis* Drury.
 1892. *ocularis* Dalman.
 1893. *imbricatus* Linnaeus.
 1894. *Sphenostethus tusci* Buquet.
 1895. *Asymum maritum* Haldeman.
 1896. *Crioceraphus obsoletus* Randall.
 1897. *agrestis* Kirby.
 1898. *Smodicum cucurbitiforme* Say.
 1899. *Hylotrupes hajulus* Linnaeus.
 1900. *ligneus* Fabricius.
 1901. *Phymatodes variabilis* Fabricius.
 1902. *infuscatus* Le Conte.
 1903. *varius* Fabricius.
 1904. *amanus* Say.
 1905. *Callidium antennatum* Newman.
 1906. *janthinum* Le Conte.
 1907. *uenum* Newman.
 1908. *Ceme rigida* Say.
 1909. *Gracilla minuta* Fabricius.
 1910. *Chion cinctus* Drury.
 1911. *Eburus quatuordecimnotata* Say.

LIST OF SPECIES—Continued.

1912. *Ronuleum atomarium* Drury.
 1913. *rufulum* Haldeman.
 1914. *Elaphidion uncinatum* Fabricius.
 1915. *incertum* Newman.
 1916. *villosum* Fabricius.
 1917. *pumilum* Newman.
 1918. *subpubescens* Le Conte.
 1919. *unicolor* Randall.
 1920. *cinerascens* Le Conte.
 1921. *Tylonotus bimaculatus* Haldeman.
 1922. *Heterachthes quadrimaculatus* Newman.
 1923. *eburnus* Newman.
 1924. *Chrysus dentatus* Newman.
 1925. *Phyton pallidum* Say.
 1926. *Obrum rubrum* Newman.
 1927. *Callimoxys sanguinicollis* Olivier.
 1928. *Molorchus bimaculatus* Say.
 1929. *Rhopulophorus longipes* Say.
 1930. *Trigidion coquus* Linnaeus.
 1931. var. *fulvipennis* Say.
 1932. *Purpuricenus humeralis* Fabricius.
 1933. var. *arillaris* Haldeman.
 1934. *Batyus suturalis* Say.
 1935. *Stenosphenus notatus* Olivier.
 1936. *Cyllene pictus* Drury.
 1937. *robiniae* Forster.
 1938. *Culloides nobilis* Say.
 1939. *Arlhopalus fulminans* Fabricius.
 1940. *Clytus marginicollis* Laporte.
 1941. *Xylotrechus colonus* Fabricius.
 1942. *sagittatus* Germar.
 1943. *quadrimaculatus* Haldeman.
 1944. *Neoclytus scutellaris* Olivier.
 1945. *luscus* Fabricius.
 1946. *cupreus* Say.
 1947. *erythrocephalus* Fabricius.
 1948. *longipes* Kirby.
 1949. *Clytanthus ruficollis* Olivier.
 1950. *albofasciatus* Laporte.
 1951. *Microclytus gazellula* Haldeman.
 1952. *Cyrtophorus verrucosus* Olivier.
 1953. *Tillomorpha geminata* Haldeman.
 1954. *Eudercus picipes* Fabricius.
 1955. *pini* Olivier.
 1956. *Atimia confusa* Say.
 1957. *Distenia undata* Olivier.
 1958. *Desmocerus palliatus* Forster.
 1959. *Noctydalis melius* Say.
 1960. *Encylops ceruleus* Say.
 1961. *Rhagium lineatum* Olivier.
 1962. *Centrodera decolorata* Harris.
 1963. *picta* Haldeman.
 1964. *Torotus trinitatus* Say.
 1965. *Aemavops discoidea* Haldeman.
 1966. *directa* Newman.
 1967. *Catantops cyanipennis* Say.
 1968. *Strangalia famelica* Newman.
 1969. *acuminata* Olivier.
 1970. *luteicornis* Fabricius.
 1971. *bicolor* Swederus.
 1972. *Typocerus zebratus* Fabricius.
 1973. *lunatus* Fabricius.
 1974. *vitulinus* Olivier.
 1975. *lugubris* Say.
 1976. *sinuatus* Newman.
 1977. *Leptura emarginata* Fabricius.
 1978. *subhamata* Randall.
 1979. *lineola* Say.
 1980. *hamatites* Newman.
 1981. *subargentea* Kirby.
 1982. *nitens* Forster.
 1983. *cordifera* Olivier.
 1984. *rubrica* Jay.
 1985. *circundata* Olivier.
 1986. *vagus* Olivier.
 1987. *proxima* Say.
 1988. *vittata* Germar.
 1989. *pubera* Say.
 1990. *mutabilis* Newman.
 1991. *Euryptera lateralis* Olivier.
 1992. *Cyrtinus pygmaeus* Haldeman.
 1993. *Psenocerus supernotatus* Say.
 1994. *Monohammus titillator* Fabricius.
 1995. *confusus* Kirby.
 1996. *scutellatus* Say.
 1997. *Dorcaschemus wilkii* Uhler.
 1998. *alternatum* Say.
 1999. *nigrum* Say.
 2000. *Helamnis cinerea* Olivier.
 2001. *Cacoplia pullata* Haldeman.
 2002. *Gues tigrina* De Geer.
 2003. *pulchra* Haldeman.
 2004. *debilis* Le Conte.
 2005. *tessellata* Haldeman.
 2006. *pulverulenta* Haldeman.
 2007. *oculatus* Le Conte.
 2008. *Plectrodera scalator* Fabricius.
 2009. *Acanthoderes quadrigibbus* Say.
 2010. *decepiens* Haldeman.
 2011. *morrisii* Uhler.
 2012. *Leptosylus aculiferus* Say.

LIST OF SPECIES—Continued.

2013. *Leptostylus parvus* Le Conte.
2014. *brunneus* Le Conte.
2015. *commixtus* Haldeman.
2016. *collaris* Haldeman.
2017. *macula* Say.
2018. *Liopus variegatus* Haldeman.
2019. *crassulus* Le Conte.
2020. *fuscularis* Harris.
2021. *alpha* Say.
2022. *var. cinereus* Le Conte.
2023. *punctatus* Le Conte.
2024. *Dectes spinosus* Say.
2025. *Lepturges symmetricus* Haldeman
2026. *quercus* Fitch.
2027. *signatus* Le Conte.
2028. *facetus* Say.
2029. *Hyperplatys aspersus* Say.
2030. *Trographus fasciata* De Geer
2031. *Ceratographus pusilla* Kirby.
2032. *Acanthocinus obsoletus* Olivier.
2033. *nodosus* Fabricius.
2034. *Pogonocherus mixtus* Haldeman.
2035. *Ecyrus dasyceus* Say.
2036. *Eupogonius tomentosus* Haldeman.
2037. *vestitus* Say.
2038. *pubescens* Le Conte.
2039. *subarmatus* Le Conte.
2040. *Oncideres cingulata* Say.
2041. *Atroxia crypta* Say.
2042. *Hippopsis lemmiscata* Fabricius.
2043. *Saperda obliqua* Say.
2044. *candida* Fabricius.
2045. *discoideu* Fabricius.
2046. *lateralis* Fabricius.
2047. *tridentata* Olivier.
2048. *restita* Say.
2049. *puncticollis* Say.
2050. *Oberea bimaculata* Olivier.
2051. *tripunctata* Swederus.
2052. *flavipes* Haldeman.
2053. *ocellata* Haldeman.
2054. *gracilis* Fabricius.
2055. *ruficollis* Fabricius.
2056. *Tetrops monostigma* Haldeman.
2057. *jucunda* Le Conte.
2058. *Tetraopes tetraophthalmus* Forster.
2059. *canteriator* Drapiez.
2060. *5-maculatus* Haldeman.
2061. *Amphionycha flammata* Newman.
2062. *Dysphuga tenuipes* Haldeman.
2063. *lævis* Le Conte.

CHRYSOMELIDÆ.
2064. *Donacia cincticornis* Newman.
2065. *palmata* Olivier.
2066. *hypoleuca* Lacordaire.
2067. *piscatrix* Lacordaire.
2068. *subtilis* Kunze.
2069. *poroncollis* Lacordaire.
2070. *sequalis* Say.
2071. *tuberculata* Lacordaire.
2072. *distincta* Le Conte
2073. *pusilla* Say.
2074. *metallica* Ahrens.
2075. *flavipes* Kirby
2076. *Hæmonia nigricornis* Kirby.
2077. *Orsodacna atra* Ahrens.
2078. *Zugophora puberula* Crotch.
2079. *Symeta ferruginea* Germar.
2080. *Lema brunneicollis* Lacordaire.
2081. *sapi* Crotch.
2082. *6-punctata* Olivier.
2083. *var. ephippiata* Lacordaire.
2084. *8-lineata* Olivier.
2085. *Crioceris aspuragi* Linnaeus.
2086. *12-punctata* Linnaeus.
2087. *Anomæa laticlavia* Forster.
2088. *Chalcinoptera dominicana* Fabricius.
2089. *Babia 4-guttata* Olivier.
2090. *Saxinis omogera* Lacordaire.
2091. *Chlamys plicata* Fabricius.
2092. *var. assimilis* Klug.
2093. *Exemum gibber* Olivier.
2094. *conspersa* Mannerheim.
2095. *Bassareus congestus* Fabricius.
2096. *formosus* Melsheimer.
2097. *var. sulphuripennis* Melsheimer.
2098. *detritus* Olivier.
2099. *mamifer* Newman.
2100. *var. luteipennis* Melsheimer.
2101. *lituratus* Fabricius.
2102. *var. lativittis* Germar.
2103. *Cryptocephalus quadrimaculatus* Say.
2104. *linoninis* Newman.
2105. *quadruplex* Newman.
2106. *guthulus* Olivier.
2107. *leucomelas* Suffrian.
2108. *venustus* Fabricius.
2109. *var. ornatus* Fabricius.

LIST OF SPECIES—Continued.

2110. *Cryptocerphalus* var. *humatus* Melsheimer.
 2111. var. *simpler* Haldeman.
 2112. *insertus* Haldeman.
 2113. *calidus* Suffrian.
 2114. *albicans* Haldeman.
 2115. *gibbicollis* Haldeman.
 2116. *trivittatus* Olivier.
 2117. *mutabilis* Melsheimer.
 2118. var. *dispersus* Haldeman.
 2119. *baduus* Suffrian.
 2120. *schreibersii* Suffrian.
 2121. *striatulus* Le Conte.
 2122. *Grilaurius equestris* Olivier.
 2123. *Pachybrachys*¹ *othonus* Say.
 2124. *trinotatus* Melsheimer.
 2125. *intricatus* Suffrian.
 2126. *tridentis* Melsheimer.
 2127. *carbonarius* Le Conte.
 2128. *luridus* Fabricius.
 2129. *atomarius* Melsheimer.
 2130. *infraustus* Haldeman.
 2131. *hepaticus* Melsheimer.
 2132. *subfasciatus* Haldeman.
 2133. *dilatatus* Suffrian.
 2134. *Monachus ater* Haldeman.
 2135. *saponatus* Fabricius.
 2136. *Diachus auratus* Fabricius.
 2137. *levis* Haldeman.
 2138. *cataris* Suffrian.
 2139. *pallidicornis* Suffrian.
 2140. *Triachus atomus* Suffrian.
 2141. *vacuus* Le Conte.
 2142. *Fida villicida* Walsh.
 2143. *longipes* Melsheimer.
 2144. *Xanthonia 10-notata* Say.
 2145. *villanota* Melsheimer.
 2146. *Myochrous dentatellus* Say.
 2147. *Glyptocassis pubescens* Fabricius.
 2148. *barbata* Say.
 2149. *Graphops pubescens* Melsheimer.
 2150. *marcescens* Crotch.
 2151. *Graphops curtipennis* Melsheimer.
 2152. *Typophorus viridicyaneus* Crotch.
 2153. *canellus* Fabricius.
 2154. var. *6-notata* Say.
 2155. var. *4-notata* Say.
 2156. var. *aterrima* Olivier.
 2157. var. *thoracica* Melsheimer.
 2158. *Metachroma quercatum* Fabricius.
 2159. *pallidum* Say.
 2160. *laterale* Crotch.
 2161. *levicollis* Crotch.
 2162. *Chrysocbus auratus* Fabricius.
 2163. *Tymnes tricolor* Fabricius.
 2164. *Colaspis bruneus* Fabricius.
 2165. *favosus* Say.
 2166. *Rhabdopterus picipes* Olivier.
 2167. *Nodonota puncticollis* Say.
 2168. *tristis* Olivier.
 2169. *Prasocuris muripes* Le Conte.
 2170. *Labidomera clivicollis* Kirby.
 2171. *Leptinotarsa decemlineata* Say.
 2172. *juncta* Germar.
 2173. *Zygogramma suturalis* Fabricius.
 2174. *Calligrapha similis* Rogers.
 2175. *elegans* Olivier.
 2176. *scalaris* Le Conte.
 2177. *philadelphicus* Linnaeus.
 2178. var. *spireus* Say.
 2179. *bigshyana* Kirby.
 2180. *Plagioderia viridis* Melsheimer.
 2181. *ariginosa* Suffrian.
 2182. *Gastroides cyaneus* Melsheimer.
 2183. *Linus lapponica* Linnaeus.
 2184. *scripta* Fabricius.
 2185. *Monocesta coryli* Say.
 2186. *Trirhabda tomentosa* Linnaeus.
 2187. *virgata* Le Conte.
 2188. *Galerucella americana* Fabricius.
 2189. *6-vittata* Le Conte.
 2190. *rufosanguinea* Say.
 2191. *integra* Le Conte.
 2192. *notulata* Fabricius.
 2193. *notata* Fabricius.
 2194. *nymphus* Linnaeus.
 2195. *tuberculata* Say.
 2196. *decora* Say.
 2197. *xanthomelena* Schrank.
 2198. *Diabrotica 18-punctata* Fabricius.
 2199. *atropensis* Say.
 2200. *vittata* Fabricius.

¹ Also some unregarded forms.

LIST OF SPECIES—Continued.

2201. *Phyllobrotica discordea* Fabricius.
 2202. *lumbata* Fabricius.
 2203. *Luperodes cyamellus* Le Conte.
 2204. *meraca* Say.
 2205. *Phyllechthrus dorsalis* Olivier.
 2206. *gentilis* Le Conte.
 2207. *Cerotoma trifurcata* Forster
 2208. *Blepharida rhois* Forster.
 2209. *Pachyonychus paradoxus* Melsheimer.
 2210. *Hypolampsis pilosa* Illiger.
 2211. *Edionychis gibbitarsis* Say.
 2212. *thoracica* Fabricius.
 2213. *vialis* Illiger.
 2214. *flumbrata* Forster
 2215. *peturista* Fabricius.
 2216. *miniata* Fabricius.
 2217. *indigoptera* Le Conte.
 2218. *limbalis* Melsheimer.
 2219. *6-maculata* Illiger
 2220. *quercata* Fabricius.
 2221. *Disonycha pennsylvanica* Illiger.
 2222. *5-vittata* Say.
 2223. *crenicollis* Say.
 2224. *caroliniana* Fabricius.
 2225. *glabrata* Fabricius.
 2226. *abbreviata* Melsheimer.
 2227. *xanthomelena* Dalman.
 2228. *collata* Fabricius.
 2229. *Sphaeroderma opima* Le Conte.
 2230. *Haltica chalybea* Illiger.
 2231. *ignita* Illiger.
 2232. *anoma* Horn.
 2233. *fuscescens* Melsheimer.
 2234. *marevagus* Horn.
 2235. *rufa* Haldeman.
 2236. *Lactica iris* Olivier.
 2237. *tibialis* Olivier.
 2238. *Diphucula bicolorata* Horn.
 2239. *Orthaltica capulina* Fabricius.
 2240. *Crepidodera rufipes* Linnaeus.
 2241. *helvina* Linnaeus.
 2242. *atriventris* Melsheimer.
 2243. *Epitrix cucumeris* Harris.
 2244. *fuscata* Crotch.
 2245. *parvula* Fabricius.
 2246. *Luperaltica fuscata* Le Conte.
 2247. *Mantura floridana* Crotch.
 2248. *Chaetocnema subcylindrica* Le Conte.
 2249. *protensa* Le Conte.
 2250. *denticulata* Illiger.
 2251. *parcepunctata* Crotch.
 2252. *Chaetocnema pulcherrima* Melsheimer.
 2253. *crenulata* Crotch.
 2254. *confusus* Crotch.
 2255. *minuta* Melsheimer.
 2256. *Systema hudsonias* Forster
 2257. *frontalis* Fabricius.
 2258. *elongata* Fabricius.
 2259. *tennata* Say.
 2260. *marginalis* Illiger.
 2261. *Glyptina spuria* Le Conte.
 2262. *brunnea* Horn
 2263. *Aphthona insolita* Melsheimer.
 2264. *Phyllotreta sinuata* Stephens.
 2265. *vittata* Fabricius.
 2266. *bipustulata* Fabricius.
 2267. *picta* Say.
 2268. *Longitarsus melanurus* Melsheimer.
 2269. *testaceus* Melsheimer.
 2270. *subrufus* Le Conte
 2271. *turbatus* Horn.
 2272. *pygmaeus* Horn.
 2273. *Dibolia borealis* Chevrolat.
 2274. *Psylliodes convexior* Le Conte.
 2275. *Microhopala vittata* Fabricius.
 2276. *xerene* Newman.
 2277. *excavata* Olivier.
 2278. *cyanea* Say.
 2279. *porcata* Melsheimer.
 2280. *melsheimeri* Crotch.
 2281. *Ortontota scapularis* Olivier.
 2282. *bicolor* Olivier.
 2283. *horni* Smith.
 2284. *dorsalis* Thunberg.
 2285. *rudra* Weber.
 2286. *nervosa* Panzer.
 2287. *Charistena aradne* Newman.
 2288. *Ortontoma plicatula* Olivier.
 2289. *Stenispus metallicus* Fabricius.
 2290. *Cassida nigripes* Olivier.
 2291. *bivittata* Say.
 2292. *Coptocycla clavata* Fabricius.
 2293. *signifera* Herbst.
 2294. *purpurata* Boheman.
 2295. *bicolor* Fabricius.
 2296. *Chelymorphus argus* Lichtenstein.

BRUCHIDÆ.

2297. *Spermophagus robinia* Schönherr.
 2298. *Bruchus pisorum* Linnaeus.
 2299. *minus* Say.
 2300. *chinensis* Linnaeus.
 2301. *4-maculatus* Fabricius.

LIST OF SPECIES—Continued.

2302. *Bruchus discoidens* Say.
 2303. *brunneatus* Horn.
 2304. *cruciatatus* Horn.
 2305. *nigrinus* Horn.
 2306. *albocutellatus* Horn.
 2307. *perforatus* Horn.
 2308. *distinguendus* Horn.
 2309. *fruterculus* Horn.
 2310. *obsoletus* Say.
 2311. *obtectus* Say.
 2312. *hibisci* Olivier.
 2313. *longistylus* Horn.
 2314. *musculus* Say.
 2315. *exiguus* Horn.
 2316. *seminulum* Horn.
 2317. *macrocerus* Horn.
 2318. *Zabrotes obliteratus* Horn.
 2319. *subnitens* Horn.
- TENEBRIONIDÆ.**
2320. *Epitragus arundinis* Le Conte.
 2321. *Phellopsis obcordata* Kirby.
 2322. *Blaps similis* Latreille.
 2323. *Polypleurus geminatus* Solier.
 2324. *ilobates pennsylvanicus* De Geer.
 2325. *Merinus laevis* Olivier.
 2326. *Hapladrus femoratus* Fabricius.
 2327. *ater* Le Conte.
 2328. *Scotobates calcaratus* Fabricius.
 2329. *Xylopinus rufipes* Say.
 2330. *saperdoides* Olivier.
 2331. *senescens* Le Conte.
 2332. *Tenebrio obscurus* Fabricius.
 2333. *molitor* Linnaeus.
 2334. *castaneus* Knoch.
 2335. *tenebrioides* Beauvois.
 2336. *Opatrinus notus* Say.
 2337. *Blapsinus mastus* Melsheimer.
 2338. *interruptus* Say.
 2339. *metallicus* Fabricius.
 2340. *Tribolium ferrugineum* Fabricius.
 2341. *confusum* Duval.
 2342. *Lophia foveola* Mulsant.
 2343. *Dinoderus punctatus* Le Conte.
 2344. *Dinoderus mastellus* Fabricius.
 2345. *senilis* Obittenden.
 2346. *Alphitobius diaperinus* Panzer.
 2347. *Dinoderus impressus* Melsheimer.
 2348. *senilis* Le Conte.
 2349. *senilis* Le Conte.
 2350. *senilis* Le Conte.
 2351. *senilis* Le Conte.
 2352. *Paratenetus punctatus* Solier.
 2353. *fuscus* Le Conte.
 2354. *gibbipennis* Motschulsky.
 2355. *Prateus fuscus* Le Conte.
 2356. *Diaperis hydni* Fabricius.
 2357. *Arrhenoplita bicornis* Olivier.
 2358. *viridipennis* Fabricius.
 2359. *Platydemus excavatum* Say.
 2360. *erythrocerum* Laporte.
 2361. *ruficollis* Laporte.
 2362. *ruficorne* Sturm.
 2363. *flavipes* Fabricius.
 2364. *ellipticum* Fabricius.
 2365. *micans* Horn.
 2366. *crenatum* Le Conte.
 2367. *picalabrum* Melsheimer.
 2368. *subcostatum* Laporte.
 2369. *Phyletus bifasciatus* Say.
 2370. *Palorus ratzeburgi* Wissmann.
 2371. *subdepressus* Wollaston.
 2372. *Hypophlaeus parallelus* Melsheimer.
 2373. *canus* Le Conte.
 2374. *thoracicus* Melsheimer.
 2375. *piliger* Le Conte.
 2376. *Pentaphyllus pallidus* Le Conte.
 2377. *Boletotherus bifurcus* Fabricius.
 2378. *Boletothugus corticola* Say.
 2379. *Helops micans* Fabricius.
 2380. *americanus* Beauvois.
 2381. *venustus* Say.
 2382. *ereus* Germar.
 2383. *Meracantha contracta* Beauvois.
 2384. *Strongylium tenuicollis* Say.
 2385. *terminatum* Say.
- CISTELIDÆ.**
2386. *Allecula punctulata* Melsheimer.
 2387. *atra* Say.
 2388. *Hymenorus niger* Melsheimer.
 2389. *pilosus* Melsheimer.
 2390. *obscurus* Say.
 2391. *communis* Le Conte.
 2392. *rufipes* Le Conte.
 2393. *Cistela brevis* Say.
 2394. *marginata* Ziegler.
 2395. *Isonira valida* Schwarz.
 2396. *sericea* Say.
 2397. *quadristriata* Couper.
 2398. *Mycetochares haldemani* Le Conte.
 2399. *fraterna* Say.
 2400. *binotata* Say.
 2401. *foveata* Le Conte.

LIST OF SPECIES—Continued.

2402. *Chromatia amana* Say.
 2403. *Chymochroa fuliginosa* Melsheimer.
 2404. *Androchirus fuscipes* Melsheimer.
 2405. *femoratus* Olivier.
- LAGRIIDÆ.**
2406. *Arthromacra wnea* Say.
 2407. *Statira resplendens* Melsheimer.
 2408. *gagatina* Melsheimer
- MONOMMIDÆ.**
2409. *Hyporhagus punctulatus* Thomson.
- MELANDRYIDÆ.**
2410. *Tetratoma truncorum* Le Conte
 2411. *tesellata* Melsheimer.
 2412. *Pisemus humeralis* Kirby.
 2413. *Penthe obliquata* Fabricius.
 2414. *punctata* Fabricius.
 2415. *Synchroa punctata* Newman.
 2416. *Eustrophus bicolor* Fabricius.
 2417. *repandus* Horn.
 2418. *tomentosus* Say.
 2419. *Holostrophus bifasciatus* Say.
 2420. *Orchesia castanea* Melsheimer.
 2421. *gracilis* Melsheimer.
 2422. *Hallomenus scapularis* Melsheimer.
 2423. *debilis* Le Conte.
 2424. *Microscapha clavicornis* Le Conte.
 2425. *Melandrya striata* Say.
 2426. *Carebara longula* Le Conte.
 2427. *Spilotus 4-pustulosus* Melsheimer.
 2428. *Euchodes sericea* Haldeman.
 2429. *Mystaria simulator* Newman.
 2430. *Hypulus lituratus* Le Conte.
 2431. *concolor* Le Conte.
 2432. *raudoueri* Mulsant.
 2433. *Symphura flavicollis* Haldeman.
 2434. *rugosa* Haldeman.
 2435. *Anisoxya glaucula* Le Conte.
 2436. *Scraptia sericea* Melsheimer.
 2437. *Allopoda lutea* Haldeman.
 2438. *Cunifa plagiata* Melsheimer.
 2439. *pusilla* Haldeman.
 2440. *pallipes* Melsheimer.
 2441. *Nothus varians* Le Conte.
 2442. *Mycterus scaber* Haldeman.
- PYTHIDÆ.**
2443. *Boros unicolor* Say.
 2444. *Pytho americanus* Kirby.
2445. *Salpingus virescens* Le Conte.
 2446. *Rhinosimus viridiannus* Randall
- CEDEMERIDÆ.**
2447. *Microtonus sericans* Le Conte
 2448. *Nacerdes melanura* Linnaeus.
 2449. *Oraris thoracica* Fabricius.
 2450. *tenidata* Le Conte.
 2451. *Probosca pleuralis* Le Conte.
 2452. *Asclera ruficollis* Say.
 2453. *puncticollis* Say.
- MORDELLIDÆ.**
2454. *Pentaria trifasciata* Melsheimer.
 2455. *Anaspis flavipennis* Haldeman.
 2456. *rufa* Say.
 2457. *Tomoxia lineella* Le Conte.
 2458. *inclusa* Le Conte.
 2459. *Mordella melana* Germar.
 2460. *scutellaris* Fabricius.
 2461. *irrorata* Le Conte.
 2462. *8-punctata* Fabricius.
 2463. *marginata* Melsheimer.
 2464. *lunulata* Helmuth.
 2465. *var. obliqua* Le Conte.
 2466. *serval* Say.
 2467. *oculata* Say.
 2468. *triloba* Say.
 2469. *undulata* Melsheimer.
 2470. *fascifera* Le Conte.
 2471. *discoidea* Melsheimer.
 2472. *Mordellistena bicinctella* Le Conte.
 2473. *arida* Le Conte.
 2474. *lutea* Melsheimer.
 2475. *trifasciata* Say.
 2476. *lepidula* Le Conte.
 2477. *limbalis* Melsheimer.
 2478. *biplagiata* Helmuth.
 2479. *rapida* Le Conte.
 2480. *decorata* Le Conte.
 2481. *fulvicollis* Melsheimer.
 2482. *ornata* Melsheimer.
 2483. *militaris* Le Conte.
 2484. *scapularis* Say.
 2485. *comata* Le Conte.
 2486. *var. cervicalis* Le Conte.
 2487. *var. picicornis* Le Conte.
 2488. *amica* Le Conte.

LIST OF SPECIES—Continued.

2489. *Mordellistena aspersa* Melsheimer.
 2490. *picilabris* Helmuth.
 2491. *infima* Le Conte.
 2492. *audreri* Le Conte.
 2493. *grammeca* Le Conte.
 2494. *ancilla* Le Conte.
 2495. *varians* Le Conte.
 2496. *ustulata* Le Conte.
 2497. *semituta* Le Conte.
 2498. *impatiens* Le Conte.
 2499. *nigricans* Melsheimer.
 2500. *ruficeps* Le Conte.
 2501. *pustulata* Melsheimer.
 2502. *convicta* Le Conte.
 2503. *fuscipennis* Melsheimer.
 2504. *morula* Le Conte.
 2505. *ambusta* Le Conte.
 2506. *unicolor* Le Conte.
 2507. *marginalis* Say.
 2508. *pubescens* Fabricius.
 2509. var. *leporina* Le Conte.
 2510. var. *hebraica* Le Conte.
 2511. *bihamata* Melsheimer.
 2512. *liturata* Melsheimer.
 2513. *fuscata* Melsheimer.
 2514. *suturcula* Helmuth.
 2515. *attenuata* Say.
 2516. *discolor* Melsheimer.
- ANTHICIDÆ.
2517. *Stereopulpus melli* Laferté.
 2518. *Corphyrus terminalis* Say.
 2519. *laniata* Say.
 2520. *lugubris* Say.
 2521. *collaris* Say.
 2522. *Xylophilus melsheimeri* Le Conte.
 2523. *basilis* Le Conte.
 2524. *nebulosus* Le Conte.
 2525. *fasciatus* Melsheimer.
 2526. *subfasciatus* Le Conte.
 2527. *notatus* Le Conte.
 2528. *piceus* Le Conte.
 2529. *brunnipennis* Le Conte.
 2530. *impressus* Le Conte.
 2531. *Macrotaria confusa* Le Conte.
 2532. *stictica* Fabricius.
 2533. *Notoxus anchora* Hentz.
 2534. *monodactylus* Fabricius.
 2535. *hastatus* Say.
 2536. *Macrotaria punctatus* Le Conte.
 2537. *Macrotaria apicatus* Say.
2538. *Anthicus sturnii* Laferté.
 2539. *myrmecoides* Hamilton.
 2540. *cinclus* Say.
 2541. *floralis* Linneus.
 2542. *vicinus* Laferté.
 2543. *confusus* Le Conte.
 2544. *scabriceps* Le Conte.
 2545. *cervinus* Laferté.
 2546. *latebrans* Le Conte.
 2547. *spretus* Le Conte.
 2548. *pubescens* Le Conte.
 2549. *fulvipes* Laferté.
 2550. *haldemani* Le Conte.
- PYROCHROIDÆ.
2551. *Ischalia costata* Le Conte.
 2552. *Pyrochroa flabellata* Fabricius.
 2553. *femoralis* Le Conte.
 2554. *Dendroides canadensis* Latreille.
- MELOIDÆ.
2555. *Meloe angusticollis* Say.
 2556. *americanus* Leach.
 2557. *marrens* Le Conte.
 2558. *Tricrania sanguinipennis* Say.
 2559. *Nemognathus nemorensis* Hentz.
 2560. *cribrarius* Le Conte.
 2561. *Zonitis bilineata* Say.
 2562. *Ilornia minutipennis* Riley.
 2563. *Macrobasis unicolor* Kirby.
 2564. *Epicauta pennsylvanica* De Geer.
 2565. *cinereus* Forster.
 2566. *vittatus* Fabricius.
 2567. *lemniscatus* Fabricius.
 2568. *strigosus* Schönherr.
 2569. *trichrus* Pallas.
 2570. *Pyrotus germari* Haldeman.
 2571. *limbalis* Le Conte.
 2572. *Pomphopoea aenea* Say.
- RHIPIPHORIDÆ.
2573. *Pelecoluma flavipes* Melsheimer.
 2574. *Rhipiphorus pectinatus* Fabricius.
 2575. *cruentus* Germar.
 2576. *limbatus* Fabricius.
 2577. *Myodites fasciatus* Say.
 2578. var. *stylopides* Newman.
- STYLOPIDÆ.
2579. *Xenos peekii* Kirby.

LIST OF SPECIES—Continued.

RHINOMACERID.E.

2580. *Rhinomacer pilosus* Le Conte.
2581. *elongatus* Le Conte.

RHYNCHITID.E.

2582. *Auletes cassandrae* Le Conte.
2583. *Eugnaptus angustatus* Herbst.
2584. *collaris* Fabricius.
2585. *Rhynchites hirtus* Fabricius.
2586. *aeneus* Boheman
2587. *teratus* Say.
2588. *Pterocolus oratus* Fabricius.

ATTELABID.E.

2589. *Attelabus analis* Illiger.
2590. *nigripes* Le Conte.
2591. *bipustulatus* Fabricius.

OTIORHYNCHID.E.

2592. *Epicærus umbricatus* Say.
2593. *Hormorus undulatus* Uhler.
2594. *Panoscopus erinaceus* Say.
2595. *Phyxelis rigidus* Say.
2596. *Otiorynchus oratus* Linnaeus.
2597. *sulcatus* Fabricius.
2598. *Cercoprus chrysorhæus* Say.
2599. *Tanymericus confertus* Gyllenhal.
2600. *Pandeletejus hilaris* Herbst.
2601. *Brachystylus acutus* Say.
2602. *Aramigus fulleri* Horn.
2603. *Aphrastus teniatus* Gyllenhal.

CURCULIONID.E.

2604. *Sitones flavescens* Marsham.
2605. *lispidulus* Germar.
2606. *Rhyernus noreboracensis* Forster.
2607. *Apion impeditum* Fall.
2608. *impunctistriatum* Smith.
2609. *coracellum* Fall.
2610. *atripes* Smith.
2611. *finitimum* Fall.
2612. *melanarium* Gerstæcker.
2613. *robustum* Smith.
2614. *minutum* Smith.
2615. *pennsylvanicum* Boheman.
2616. *perminutum* Smith.
2617. *reclusum* Fall.
2618. *cozole* Fall.
2619. *tenacirostris* Smith.
2620. *conspicua* Smith.

2621. *Apion patrule* Smith.
2622. *walshii* Smith
2623. *perforicollis* Fall.
2624. *norellum* Fall.
2625. *turbulentum* Smith.
2626. *griseum* Smith.
2627. *porcatum* Boheman.
2628. *rostrum* Say.
2629. *nigrum* Herbst.
2630. *segnipes* Say.
2631. *ventricosum* Le Conte.
2632. *decoloratum* Fall.
2633. *emacipes* Fall.
2634. *carinatum* Smith.
2635. *parallellum* Smith.
2636. *purdanum* Fall.
2637. *herculanum* Smith.
2638. *Podapion gillicola* Riley.
2639. *Phytonomus comptus* Say.
2640. *punctatus* Schonherr.
2641. *Listronotus tuberosus* Le Conte.
2642. *callosus* Le Conte.
2643. *inequalipennis* Boheman.
2644. *caudatus* Say.
2645. *appendiculatus* Boheman.
2646. *sulcirostris* Le Conte.
2647. *latusculus* Boheman.
2648. *Macrops solutus* Boheman.
2649. *sparsus* Say.
2650. *porcellus* Say.
2651. *Pissodes strobis* Peck.
2652. *Pachyllobius pictoratus* Germar.
2653. *Hyllobius pales* Herbst.
2654. *Eudocimus mannerheimii* Boheman
2655. *Lixus terminalis* Le Conte.
2656. *rectus* Le Conte.
2657. *convexus* Say.
2658. *musculus* Say.
2659. *scrolicollis* Boheman.
2660. *sylvius* Boheman.
2661. *juelichi* Casey.
2662. *Dorytomus brevicollis* Le Conte.
2663. *Pachyphonus amoenus* Say.
2664. *Smicronyx squalidus* Casey.
2665. *tesselatus* Dietz.
2666. *languidulus* Dietz.
2667. *atratus* Dietz.
2668. *congestus* Casey.
2669. *sculpticollis* Casey.
2670. *apionides* Casey.

LIST OF SPECIES—(Continued.)

2671. <i>Smicromyr nebulosus</i> Dietz.	2722. <i>Anthonomus nubilus</i> Le Conte.
2672. <i>maculatus</i> Dietz.	2723. <i>elongatus</i> Le Conte.
2673. <i>corniculatus</i> Fabricius.	2724. <i>Pseudanthonomus cratagi</i> Walsh.
2674. <i>lanuginosus</i> Dietz.	2725. <i>incipiens</i> Dietz
2675. <i>sparsus</i> Casey.	2726. <i>sericesetosus</i> Dietz
2676. <i>Promecotarsus gibbirostris</i> Casey.	2727. <i>longulus</i> Dietz
2677. <i>Phyllotrox ferrugineus</i> Le Conte.	2728. <i>rigulus</i> Dietz.
2678. <i>Brachybanus electus</i> Germar.	2729. <i>Xanthus pygmaeus</i> Dietz.
2679. <i>Onychylis nigrirostris</i> Boheman.	2730. <i>hiputatus</i> Dietz.
2680. <i>Endalus limatulus</i> Gyllenhal.	2731. <i>Elleschus ephippiatus</i> Say.
2681. <i>cribricollis</i> Le Conte.	2732. <i>Acalyptus carpini</i> Herbst.
2682. <i>oralis</i> Le Conte.	2733. <i>Orchestes salicis</i> Linneus.
2683. <i>Tunysphyrus tenuis</i> Fabricius.	2734. <i>niger</i> Horn.
2684. <i>Anchodemus angustus</i> Le Conte.	2735. <i>pallidicornis</i> Say.
2685. <i>Lissorhoptus simplex</i> Say.	2736. <i>betuleti</i> Horn.
2686. <i>apiculatus</i> Gyllenhal.	2737. <i>Prionomerus calcatus</i> Say.
2687. <i>Bugons</i> ¹ <i>mammillatus</i> Say.	2738. <i>Piazorhinus scutellaris</i> Say.
2688. <i>magister</i> Le Conte.	2739. <i>pictus</i> Le Conte.
2689. <i>transversus</i> Le Conte.	2740. <i>Thysanocnemis helveticus</i> Le Conte.
2690. <i>bituberosus</i> Le Conte.	2741. <i>fraxini</i> Le Conte.
2691. <i>Otidoccephalus myrmer</i> Herbst.	2742. <i>Plocetes ulmi</i> Le Conte.
2692. <i>chevrolatii</i> Horn.	2743. <i>Gymnetron teter</i> Fabricius.
2693. <i>hericollis</i> Horn.	2744. <i>Miarus hispidulus</i> Le Conte.
2694. <i>serobicollis</i> Boheman.	2745. <i>Laemosaccus plagiatus</i> Fabricius.
2695. <i>Mugilalis perforata</i> Horn.	2746. <i>Conotrachelus juglandis</i> Le Conte.
2696. <i>olyra</i> Herbst.	2747. <i>albicinctus</i> Le Conte.
2697. <i>hispidus</i> Le Conte.	2748. <i>nemuphar</i> Herbst.
2698. <i>pandura</i> Say.	2749. <i>seniculus</i> Le Conte.
2699. <i>pallida</i> Say.	2750. <i>affinis</i> Boheman.
2700. <i>Tachypterus quadrigibbus</i> Say.	2751. <i>elegans</i> Say.
2701. <i>Anthonomus rubidus</i> Le Conte.	2752. <i>cratagi</i> Walsh.
2702. <i>gularis</i> Le Conte.	2753. <i>naso</i> Le Conte.
2703. <i>virgo</i> Dietz.	2754. <i>posticatus</i> Boheman.
2704. <i>sycophanta</i> Walsh.	2755. <i>geminatus</i> Le Conte.
2705. <i>nutricula</i> Le Conte.	2756. <i>cribricollis</i> Say.
2706. <i>corvulus</i> Le Conte.	2757. <i>tuberosus</i> Le Conte.
2707. <i>subguttatus</i> Dietz.	2758. <i>anaglyphicus</i> Sav.
2708. <i>signatus</i> Say.	2759. <i>flavunguis</i> Le Conte.
2709. <i>consimilis</i> Dietz.	2760. <i>erinaceus</i> Le Conte.
2710. <i>musculus</i> Say.	2761. <i>hispidus</i> Le Conte.
2711. <i>sulcifrons</i> Le Conte.	2762. <i>Rhyssomatus lineaticollis</i> Say.
2712. <i>interstitialis</i> Dietz.	2763. <i>aequalis</i> Horn.
2713. <i>nigrinus</i> Boheman.	2764. <i>Chalcodermus collaris</i> Horn.
2714. <i>scutellatus</i> Gyllenhal.	2765. <i>Microhyus setiger</i> Le Conte.
2715. <i>juniperinus</i> Sanborn.	2766. <i>Acamptus rigidus</i> Le Conte.
2716. <i>orchestoides</i> Dietz.	2767. <i>Acalles carinatus</i> Le Conte.
2717. <i>disjunctus</i> Le Conte.	2768. <i>sordidus</i> Le Conte.
2718. <i>sulfuratus</i> Le Conte.	2769. <i>clavatus</i> Say.
2719. <i>robustus</i> Le Conte.	2770. <i>pectoralis</i> Le Conte.
2720. <i>moleculus</i> Casey.	2771. <i>crassulus</i> Le Conte.
2721. <i>unguicollis</i> Le Conte.	2772. <i>Tyloderma foveolatum</i> Say.

¹ Two undetermined species.

LIST OF SPECIES—Continued.

- 2773 *Tuloderma fragariae* Riley
 2774 *arenaria* Say.
 2775 *Phydroneus undatus* Le Conte
 2776 *Cryptorhynchus parochus* Herbst.
 2777 *bisignatus* Say.
 2778 *fuscatus* Le Conte.
 2779 *obtusatus* Herbst.
 2780 *juddi* Le Conte.
 2781 *mutissimus* Le Conte.
 2782 *tristis* Le Conte.
 2783 *ferratus* Say.
 2784 *Piazurus oculatus* Say.
 2785 *Oxyturus bimotus* Le Conte
 2786 *acutus* Le Conte.
 2787 *longulus* Le Conte.
 2788 *quercus* Say.
 2789 *minutus* Le Conte.
 2790 *Acoptus suturalis* Le Conte.
 2791 *Tachygonus lecontei* Gyllenhal.
 2792 *tartarus* Le Conte.
 2793 *Mononychus vulpeculus* Fabricius.
 2794 *Criponus inaequalis* Say
 2795 *Acanthoscelis curtus* Say.
 2796 *acephalus* Say.
 2797 *tachygonus* Dietz.
 2798 *Auletes nebulosus* Le Conte.
 2799 *asper* Le Conte.
 2800 *Pelenomus cristatus* Dietz.
 2801 *Acanthodes ventricosus* Le Conte.
 2802 *Ceutorhynchus rapax* Gyllenhal.
 2803 *sulcipennis* Le Conte.
 2804 *pugio* Le Conte.
 2805 *atriculus* Dietz
 2806 *anthonomoides* Dietz.
 2807 *squamatus* Le Conte.
 2808 *siculus* Dietz.
 2809 *erythropus* Dietz.
 2810 *septentrionalis* Gyllenhal.
 2811 *puberulus* Le Conte.
 2812 *zimmermanni* Gyllenhal.
 2818 *Ceilogaster zimmermanni* Gyllenhal
 2814 *Perigaster cretura* Herbst.
 2815 *Pelenomus sulcicollis* Fabricius.
 2816 *Rhinoncus pericarpus* Linnæus.
 2817 *pyrrhopus* Le Conte.
 2818 *longulus* Le Conte.
 2819 *Baris umbilicatus* Le Conte.
 2820 *tumescens* Le Conte.
 2821 *subvirens* Le Conte.
 2822 *Baris dolosa* Casey.
 2823 *confinis* Le Conte.
 2824 *discipula* Casey.
 2825 *Plasobaris T-signum* Boheman
 2826 *disjuncta* Casey.
 2827 *Glyptobaris rugicollis* Le Conte.
 2828 *Oxylobaris pectorosa* Le Conte.
 2829 *Mutarellus undulatus* Say
 2830 *Antobaris pusilla* Le Conte.
 2831 *scoloparia* Sav.
 2832 *Ampelogypter ater* Le Conte
 2833 *longipennis* Casey.
 2834 *Dermoglyptus crenatus* Le Conte.
 2835 *Pseudobaris pectoralis* Le Conte.
 2836 *nigritus* Say
 2837 *Trichobaris trimotata* Say.
 2838 *Centrinus piceiventris* Herbst.
 2839 *albiterius* Casey.
 2840 *percellus* Gyllenhal.
 2841 *clarescens* Casey.
 2842 *percellus* Herbst.
 2843 *penicellus* Herbst.
 2844 *scutellum-album* Say.
 2845 *Centrinopus alternatus* Casey.
 2846 *Nicentrus lineicollis* Boheman.
 2847 *Limnobaris braccata* Casey.
 2848 *limbifer* Casey.
 2849 *grisea* Le Conte.
 2850 *confusa* Boheman.
 2851 *confinis* Le Conte.
 2852 *concurrentis* Casey.
 2853 *calva* Le Conte.
 2854 *Oligolorius convexus* Le Conte.
 2855 *Iliostethus tubulatus* Say.
 2856 *Strithobaris corpulenta* Le Conte.
 2857 *oratu* Le Conte.
 2858 *Zaglyptus striatus* Le Conte.
 2859 *sulcatus* Le Conte.
 2860 *Ommorphidius larvicollis* Le Conte.
 2861 *Barinus crillicollis* Le Conte.
 2862 *curticollis* Casey.
 2863 *Barilepton filiforme* Le Conte.
 2864 *Plocamus hispidulus* Le Conte.
 2865 *Balaninus caryatipes* Boheman.
 2866 *quercus* Horn.
 2867 *uniformis* Le Conte.
 2868 *nasicus* Say.
 2869 *rectus* Say.
 2870 *Eupaulis minutus* Drury.

BRENTHIDÆ.

LIST OF SPECIES—Continued.

CALANDRIDÆ.

2871. *Rhodobrenus 13-punctatus* Illiger.
 2872. *Sphenophorus ochreus* Le Conte.
 2873. *inæqualis* Say.
 2874. *pertinax* Olivier.
 2875. *cariosus* Olivier.
 2876. *sculptus* Uhler.
 2877. *zeæ* Walsh.
 2878. *melanocephalus* Fabricius.
 2879. *placidus* Say.
 2880. *parvulus* Gyllenhal.
 2881. *germari* Horn.
 2882. *Calandra oryze* Linnæus.
 2883. *granaria* Linnæus.
 2884. *Dryophthorus corticalis* Say.
 2885. *Himatium errans* Le Conte.
 2886. *conicum* Le Conte.
 2887. *Cossonus impressifrons* Boheman.
 2888. *Stenomimus pallidus* Boheman.
 2889. *Phæophagus apionides* Horn.
 2890. *minor* Horn.
 2891. *Wollastonia quercicola* Boheman.
 2892. *Amaurorhinus nitens* Horn.
 2893. *Pentarthrus parvicollis* Casey.
 2894. *Hexarthrum ulkei* Horn.
 2895. *Rhyncholus oregonensis* Horn.
 2896. *Stenoscelis brevis* Boheman.

SCOLYTIDÆ.

2897. *Scolytus quadrispinosus* Say.
 2898. *muticus* Say.
 2899. *rugulosus* Ratzeburg.
 2900. *Chramesus icoria* Le Conte.
 2901. *Phæotribus liminaris* Harris.
 2902. *frontalis* Fabricius.
 2903. *Hylesinus fasciatus* Le Conte.
 2904. *aculeatus* Say.
 2905. *opaculus* Le Conte.
 2906. *Onesimus strigicollis* Le Conte.
 2907. *Phæosinus dentatus* Say.
 2908. *Carpoborus bifurcus* Zimmermann.
 2909. *Dendroctonus terebrans* Olivier.
 2910. *frontalis* Zimmermann.
 2911. *Hylastes porculus* Erichson.
 2912. *cavernosus* Zimmermann.
 2913. *tenuis* Zimmermann.
 2914. *Hypargops pinifex* Fitch.
 2915. *Cryptorhynchus abietinus* Schwarz.
 2916. *Cryphalus rigidus* Le Conte.
 2917. *Cocotrypes dactyliperda* Fabricius.
 2918. *Hypothemus eruditus* Westwood.
 2919. *dissimilis* Zimmermann.
 2920. *Pityophthorus minutissimus* Zimmermann.
 2921. *pallus* Zimmermann.
 2922. *pulicarius* Zimmermann.
 2923. *puberulus* Le Conte.
 2924. *annectens* Le Conte.
 2925. *consimilis* Le Conte.
 2926. *hirticeps* Le Conte.
 2927. *Pityogenes plagiatus* Le Conte.
 2928. *Xylocleptes decipiens* Le Conte.
 2929. *Tomicus calligraphus* Germar.
 2930. *rucographus* Le Conte.
 2931. *pini* Say.
 2932. *arvensis* Eichhoff.
 2933. *exilatus* Eichhoff.
 2934. *Dryocetes granicollis* Le Conte.
 2935. *Mirvus suturalis* Le Conte.
 2936. *opacicollis* Le Conte.
 2937. *rudis* Le Conte.
 2938. *Thyanoes fimbriicornis* Le Conte.
 2939. *Gnathotrichus materiarius* Fitch.
 2940. *asperulus* Le Conte.
 2941. *Xyleborus tachygraphus* Zimmermann.
 2942. *dispar* Fabricius.
 2943. *celsus* Eichhoff, female.
 biographus Le Conte, male.
 2944. *fuscatus* Eichhoff, female.
 planicollis Zimmermann, male.
 pubescens Zimmermann, female.
 retusicollis Zimmermann, male.
 2945. *xylographus* Say.
 2946. *Xyloterus scabricollis* Le Conte.
 2947. *politus* Say.
 2948. *Corhythus punctatissimus* Zimmermann.
 2949. *Monarthrum fasciatum* Say.
 2950. *mali* Fitch.
 2951. *Platypus flavicornis* Fabricius.
 2952. *quadridentatus* Olivier.

LIST OF SPECIES—Continued.

ANTHRIBIDÆ.

- | | |
|--|---|
| 2954. <i>Eurymycter fuscatus</i> Olivier. | 2964. <i>Anthribus cornutus</i> Say. |
| 2955. <i>Tropideres bimaculatus</i> Olivier. | 2965. <i>Cratopus limatus</i> Fabricius. |
| 2956. <i>rectus</i> Le Conte. | 2966. <i>lugubris</i> Olivier. |
| 2957. <i>Hormiscus saltator</i> Le Conte. | 2967. <i>Brachytarsus alternatus</i> Say. |
| 2958. <i>Thorotropis pusillus</i> Le Conte. | 2968. <i>limbatus</i> Say. |
| 2959. <i>fuscatus</i> Le Conte. | 2969. <i>tomentosus</i> Say. |
| 2960. <i>Eusphyrus walshii</i> Le Conte. | 2970. <i>variegatus</i> Say. |
| 2961. <i>Piezocorynus dispar</i> Gyllenhal. | 2971. <i>Anthribulus rotundatus</i> Le Conte. |
| 2962. <i>mæstus</i> Le Conte. | 2972. <i>Choragus zimmermanni</i> Le Conte. |
| 2963. <i>nitens</i> Le Conte. | 2973. <i>sayi</i> Le Conte. |
| | 2974. <i>nitens</i> Le Conte. |
| | 2975. <i>Eurenus punctatus</i> Le Conte. |

ECOLOGICAL NOTES.

CICINDELIDÆ.

Tetracha virginica, not common; single specimens have been found at various places.

Cicindela rugifrons, on the hills near Benning Station, not rare many years ago, but not found again; *sexguttata*, common in the woods in early spring; *purpurea*, rare; *rufipennis* and *repanda*, common everywhere on open sandy places, especially near water; *hirticollis* and *marginata*, on sand banks of the lower Potomac, where the water begins to be brackish; *punctulata*, our commonest species, abundant in the streets and attracted by electric lights; *rufiventris*, not rare in the fall, across the Free Bridge, also found at Bladensburg.

CARABIDÆ.

Omophron labiatum, hitherto only found at electric lights in June; *americanum*, common along the Potomac and Eastern Branch.

Cychrus stenostomus, in woods at various places during the whole year; *elevatus*, like *stenostomus*, not common; *unicolor*, across the Free Bridge, not rare in former years; *viduus*, found only once near Chain Bridge.

Carabus. All species are found in woods at various places; *limbatus*, very common; *syboeus*, rather rare.

Calosoma. All species are extremely abundant at electric lights, but not commonly found elsewhere.

Elaphrus riparius and *ruscarius*, on mud banks along streams.

Notiophilus. The species are common in dry woods under old leaves.

Nebria pullipes, common along water courses.

Pasinachus depressus, rather common under stones and logs in dry places; *sublaevis*, the same, but rare.

Scarites subterraneus, very common everywhere under stones in the ground.

Dyschirius globulosus, common under leaves in rather wet places; *haemorrhoidalis*, near pools of stagnant water; *sphaericollis*, along the Potomac; *pumilus* and *pilosus*, the same.

Clivina punctigera, only a few specimens were found at electric lights; *planicollis*, rare; all the other species are common along the Potomac and Eastern Branch, under stones in moist places.

Aspidoglossa subangulata, along the Potomac, not common, but more abundantly found at electric lights.

Schizogenius, abundant along streams.

Ardistomis obliquatus, not common, on the Eastern Branch, near Benning; *viridis*, very abundant along the Potomac.

Panagæus fasciatus, on grassy hills under flat stones, not uncommon at electric lights.

Bembidium punctatostriatum. This and all the other species occur along the water courses, especially on sandy and pebbly places.

Anillus fortis, our only blind Carabid, found under deeply interred stones.

ECOLOGICAL NOTES—(Continued).

- Tachys*. All the species occur abundantly along streams, except *namus* and *flavicauda*, which are common under bark of decaying logs.
- Pericompsois ephippiatus*, along the shore of the Potomac.
- Petrobius longicornis*, common with *Nebria pallipes*.
- Myus coracinus*, two specimens found some years ago in the woods near Mount Pleasant.
- Pterostichus*. The species are more or less common in the woods. Among the less common species are *ebenus*, *diligendus*, *rotundatus*, *approximatus*, and *gravis* of which only two specimens were found.
- Eranthrus*, like *Pterostichus*, rather rare.
- Amara*, found more or less common everywhere, in woods, on hills, along streams, etc.; only *crassipinus* and *cupreolata* are less frequent.
- Loricandrus*, common on swampy places across the Free Bridge.
- Diplochila laticollis*, not very common along the river.
- Dicelus*, not rare under stones and logs.
- Badister notatus* and *reflexus* common in moist places under old leaves; *flavipes*, very rare; *pulchellus* and *maculatus* found only at electric lights; only two specimens of the latter have been found.
- Culathus*, very common everywhere.
- Platynus caudatus*, very rare in moist places in spring; *picicornis*, only one specimen found at electric light; *sinuatus*, not rare under loose bark of trees; the others are all more or less common under old rubbish along the streams.
- Olisthopus parvatus*, common; *micans*, rare.
- Perigona*, both species found once gregariously in moist places.
- Atranius pubescens*, very common under old leaves in moist grounds.
- Leptotrachelus dorsalis*, not common.
- Uvanonia pennsylvanica*, extremely common; *ludoviciana*, apparently not rare in swamps near Eastern Branch.
- Galerita janus*, very common; *bicolor*, less common.
- Thalpius dorsalis*, a single specimen at electric light.
- Tetragonoderus fuscatus*, common on dry sand banks along streams.
- Nemotarsus elegans*, very rare; once found at High Island.
- Lebia*, more or less common on flowers, under stones, chips, and old leaves; *marginecollis*, *pleuratica*, *fuscata*, and *abdominalis*, rather rare.
- Coptoderus aerata*, common on stumps and logs.
- Dromius piceus*, under bark, common.
- Apristus subdecaus*, common on sand banks near the river, *cordicollis*, one specimen.
- Blechnus pusio*, amongst the roots of grasses in dry meadows.
- Metabletus americanus*, near the District in Maryland.
- Plochionus timidus*, rare, beaten from trees.
- Pumilio limbatu*, common; *platycollis*, rather rare.
- Caminus pilosa* and *neglecta*, very common, under stones in dry localities; *americana*, less common; *elegans*, very rare.
- Apenes lucidula*, not common; *sinuata*, more frequent.
- Helluomorphus bicolor* and *nigripennis*, both rare.
- Brachynus*. All species of this genus are more or less common, and their specific value is by no means established.
- Chlenius leucometis* and *prasinus* are on river banks; *niger* sometimes at electric lights; the other species are common everywhere.
- Brachylobus lithophilus*, like *Chlenius prasinus*.
- Lachnoderpis parallelus*, rather rare in swampy places.
- Inatrichis minuta*, only a single specimen found.
- Oodes amaroides*, found in very wet places, not common; *americanus*, the same, very common.
- Erolenes curvatus*, several specimens found, very rare.
- Geopinus incrassatus*, not rare, but found by hundreds at electric lights.

ECOLOGICAL NOTES—Continued.

Crataeanthus dubius, one of our most common Carabids.

Agonoderus. All species of this genus are common, except *indistinctus*, *testaceus*, and *micrus*.

Discoderus tenebrosus, very rare.

Gynandropus hylaeus, very common.

Harpalus euliginosus, extremely abundant, especially at electric lights in midsummer; all the other species are more or less common everywhere.

Selenophorus pedicularius. This and the other species are common; especially at electric lights.

Stenolophus, common on wet places, except *alternans*, which is very rare on mud banks near the Potomac.

Acupalpus, like *Stenolophus*.

Bradyellus linearis, many specimens of this rare species found near swampy places in spring; the other species are common in moist grounds.

Tachycellus, common, like *Stenolophus*.

Anisodactylus discoideus and *baltimorensis*, abundant along the rivers and at electric lights; *latus* rather rare; the remaining species are common everywhere.

Xestonotus lugubris, not common, along the river.

Amphasia interstitialis, very common.

Anisotarsus terminatus, common; *nitidipennis*, less common.

Spongopus verticalis, rare.

HALIPLIDÆ.

Haliplus triopsis, common in ponds of stagnant water; *punctatus*, rare; *ruficollis*, one specimen found.

Cnemidotus simplex and *12 punctatus*, in ponds of stagnant water.

DYTISCIDÆ.

Canthidrus and *Hydrocethus*, abundant in stagnant water.

Laccophilus, common in ponds and flowing water.

Hydrocatus and *Desmopachria*, abundant in stagnant water.

Bidessus, common, except *flavicollis* and *granarius*.

Celina angustata, very common in pools on the Potomac Flats.

Celambus nubilus, common, *dissimilis*, one specimen.

Hydroporus, all the species are more or less common in brooks and creeks; *obtus*, in cold springs.

Ilybius lagutulus, very common, especially at the electric lights.

Coptotomus and *Copelatus*, abundant.

Matus incarnatus, not common.

Agabus acunductus, rare.

Agabus erythropterus, rare in springs, the rest more or less common.

Rhantus calulus, two specimens at electric light.

Hydaticus bimarginatus, few specimens at electric light.

Dytiscus hybridus, rare.

Aeilus medius, not rare.

Thermonectes basilaris, very abundant, especially at electric lights; *ornaticollis*, rare.

Graphoderus liberus, rare.

Cybister fimbriolatus, common in ponds.

GYRINIDÆ.

Dineutes, more or less abundant in schools in stagnant and running waters.

Gyrinus, like *Dineutes*.

Helophorus lineatus, in ponds, common; *inguinatus*, less common.

Hydrochus mihetiprens, very abundant in ponds; *scabratus* and *inaequilis*, not common.

Hydrenus pennsylvanica, extremely abundant.

Hydrophilus triangularis, very abundant at electric lights; also *oratus*, but less abundant.

Tropisternus and *Hydrochuris*, common at electric lights.

Berosus peregrinus and *striatus*, very common; *exiguus*, rare.

Laccobius agilis, extremely abundant everywhere.

Philhydus, all common, except *perplexus*.

Helochares maculicollis, common.

Helocombus bifidus, rare.

Cymbiodyla fimbriata, not rare; *blanchardi*, rare.

ECOLOGICAL NOTES—(Continued).

Hydrobius tessellatus, very rare; the others common.

Creniphilus subcupreus, very abundant in running water.

Phanomotum evstriatum, in swamps.

Cercyon unipunctatus, in horse dung; *pratensis*, in dung and decaying plants; *indistinctus*, one specimen, *hemorrhoidalis*, in fungi; also *navicularis* and *pubescens*, the rest are more or less common in rotten vegetable matter.

Cryptopleurum minutum, common; *americanum*, very rare.

Pemelus costatus, very rare in rotten fungi.

LEPTINIDÆ.

Leptinus testaceus, in the nests of wood mice (*Arvicola*), in different localities.

SILPHIDÆ.

Necrophorus americanus, on dead snakes; also at electric lights; the others are found on various dead animals.

Silpha surinamensis, very abundant, especially at electric lights; this and the others are found on putrid matters; common.

Pinodytes cryptophagoides, blind, under decayed leaves in rather moist places. This species, in company with *Eutypophilus similis* and *Anillus fortis*, both blind, is frequently found in the mountains of Virginia.

Cholera. All the species are found under old leaves, in fungi, and on dead animals.

Prionocheta opaca, like *Cholera*.

Ptomaphagus ulkri, only two specimens were found under decayed leaves, across the Free Bridge; *parasitus*, in the nests of *Formica integra*.

Colo. Of *paradoxum*, *hubbardi*, *thoracicum*, and *asperatum*, only single specimens have been found.

Anisotoma obsoleta, not rare; of *alternata* and *assimilis* only single specimens; species of this genus are to be found either under old leaves or in beating meadows at sunset in early summer.

Onitis impunctata, very common in fungi and under old leaves.

Liodes. All hve in rotten wood, permeated with fungus growth.

Cyrtusa, beaten from grass on warm summer evenings, common.

Isoplastus fossor, like *Cyrtusa*, but rare.

Agathidium, in rotten wood and under old bark.

Aglyptus levis, like *Agathidium*.

Clambus gibbulus, under flood debris; *puberulus*, less common.

SCYDMÆNIDÆ.

Cherolatus amena, sifted from old leaves, very rare.

Brachyrepis, not rare, under old leaves.

Seydianus rarus, under bark of old stumps, always in company with *Lasius alienus*; all the other species occur under old leaves in damp places.

Eumicrus motschulskii, very abundant; *grossus*, rather rare.

Cholerus zimmermanni, rather rare.

Cephenium corporosum, not rare under old leaves.

PSELAPHIDÆ.

Adranes lecontei, very rare, with *Lasius clariger*.

Crophylus monilis, rare, under bark of rotten trees.

Cedius zieglerei, common in the hills of *Formica integra* and *exsectoides*; *spinosus*, under loose bark of old trees.

Thysiphorus, like *Crophylus*.

Chennium monilicorne, very rare, with *Psenolepis parvula*.

Genistes, all the species are abundant under old leaves.

Tyrus humeralis, rare, under bark of old trees.

Pselaphus erichsonii, one specimen under a stone near Woodley Park.

Tychus longipalpus and *minor*, both frequently found under old leaves in rather dry places.

Eutrichites zimmermanni, rare.

Nisaxis tomentosa, rare.

Decarthron stigmatum with *Aphaenogaster trecki*; *exsectum*, one specimen found; the rest by sifting old leaves and sweeping meadow grass at sunset.

ECOLOGICAL NOTES—Continued.

Bryaxis, most all of the species are found by beating grassy places toward sunset in the early part of June; *valida*, two specimens, near Free Bridge; *belfragei*, two specimens; *geminifer*, one specimen. *Arthmus globicollis*, exceedingly abundant under old leaves in moist places.

Batriscus ionie, rare, with *Lasius alienus*; *monstrosus* and *ferox* occur with *Lasius claviger* and *interjectus*; *nigricans* and *triangulifer*, only single specimens; *globosus*, very common.

Trimium, sifted from decayed roots in the grounds, also beaten from grasses at sunset.

Rheridius canaliculatus, one specimen.

Rherius unsculptus, taken abundantly by sweeping.

Therium carifrons, two specimens.

Trimiopterus arcuatus, one specimen.

Euplectus, generally found in rotten wood.

Eutypilus similis, very common with *Pinodytes cryptophagoides*.

STAPHYLINIDÆ.

Aleochara lata, common under carcasses; the others very common under dung.

Orypoda sagulata, excessively common; most of the species are common under dung; several undescribed species.

Xenodusa cava, found in the nests of *Camponotus pennsylvanicus*.

Myrmecodia rudis, very rare; *schwarzi*, in the nests of *Lasius alienus*.

Philothermes pennsylvanicus, among *Termes*, not rare.

Hoplandria lateralis, very common under old leaves and carcasses.

Atheta, most of the species remain undetermined.

Tachysus, like *Atheta*.

Falagria bilobata, this and the other species are more or less abundant under old leaves.

Euryusa obtusa, not rare in the nests of *Formica integra* and *exsectoides*.

Leptusa, the species are common under moist bark.

Placusa, like *Leptusa*.

Gyrophenia, all species live in toadstools.

Myllena and *Dinopsis*, in old moist leaves and flood debris. Several genera

and a great number of species of the *Aleocharinae* remain as yet unrecognized and undescribed.

Acylophorus flavicollis and *pronus*, common under debris near water; *densus*, very rare.

Heterothops pusio, not rare.

Quedius ferox, rather rare; the others are abundant under old leaves, stones, etc.

Listotrophus cingulatus, very common under decaying vegetable and animal matter.

Creophilus villosus, like the preceding.

Staphylinus vulpinus, under old leaves, common; *maculosus*, in decaying fungi, dung; *fossator*, decaying fungi; *violaceus*, very abundant in old fungi; *comes*, *arulans*, both rare under dung; *prionogus* and *viridans*, each one specimen.

Ocypus ater, rare under stones.

Belonuchus formosus, very abundant on sap exuding from wounded trees.

Tympanophorus puncticollis, very rare.

Philonthus politus, rare; *umbratilis*, *luculus*, *inquietus*, each one specimen; *asper*, not rare in the stems of toadstools; *hepaticus*, very abundant under dry leaves; *umbrinus*, under old leaves near the river; most of the other species are more or less abundant under old dung or decaying fungi.

Actobius cinerascens, under debris along the river, common; also *sobrinus* and *paederoides*, very abundant; of *procerulus*, *parvus*, *terminalis* and *lepidulus*, single specimens.

Xantholinus fulgidus and *temporalis*, rare; *cephalus*, under bark of trees; *emmesus*, abundant under bark and old leaves; *hamatus*, common under decaying weeds.

Leptolinus rubripennis, not rare in debris along the river.

Leptacinus, all very common under old leaves.

Diachus schaumii, common everywhere.

Stenus. Most species of this genus live on sand banks near streams, some of them gregariously in great numbers; of *delawarensis* only found two specimens under debris on the Potomac Flats, and *dispar*, on the hills across the Free Bridge.

ECOLOGICAL NOTES—Continued.

- Euesthetus americanus*, under moist leaves
Edaphus nitidus, under moldy leaves.
Stetocranus puncticeps, under old leaves, but not common.
Cryptobium bicolor, *pallipes*, *carolinum*, common in swampy places near the river; *badium* and *cribratum*, rather rare; *serpentinum* and *flavicornis*, very rare.
Lathrobium, all very common under old leaves, except *armatum*, *simile* and *umbrosum*.
Scaphus, like *Lathrobium*, common.
Stilicus tristis and *biarmatus*, rare; *dentatus*, common in fungi.
Lithocharis ochracea, rather common
Aderocharis corticina, very common under moist old leaves.
Trachysaetus confusus, under moist bark of old trees, abundant.
Pæderus littorarius, very abundant everywhere.
Senius, like *Pæderus*.
Echiaster (*Leptogenius*), an apparently undescribed species, not rare under old leaves.
Silicopsis monstrosa, common; *paradoxa*, very rare.
Pinophilus latipes, not rare under stones; *picipes*, one specimen.
Palaminus testaceus, common; *contortus*, rare.
Microcryptus testaceus, one specimen among termites.
Tuchinus memnonius, *luridus*, *flavulus*, *fimbriatus*, *pallipes*, in fungi; *fumipennis*, common in dung; *repundus*, *limbatus*, and *nitiduloides* under old leaves.
Tachyporus, all under old leaves and stones; *maculipennis*, rare.
Olea aliphoides, very abundant in horse manure.
Brachinus ventriculus, abundant under moist old bark; *levis*, under old leaves.
Cinagrus. All the species of this genus live under old leaves or on fungi growing on dead trees.
Polysphindus, more or less common in fungi.
Polysphindus ruficornis, very abundant under old leaves. *leopet*, two specimens.
Polysphindus, all species, under old leaves.
Megalops carlatus, very rare, on fungi growing under logs.
Cryptopus, all the species live exclusively in toadstools.
Chorus latipes, not rare, burrowing in the ground under stones.
Holotrochus loricatus, rather rare.
Blodius. These species live on mud or sand banks near the river.
Platystethus americanus, exceedingly common in dung.
Orytelus. These species, with the exception of *placatus*, which is myrmecophilous, live either in dung or decaying vegetation.
Trogophorus, all live on mud banks or in decaying leaves in muddy swamps.
Ipocellus sphaericollis, very common under stones, everywhere.
Lucyphorus, found on stones in a small creek near Cabin John Bridge.
Thinobius fimbriatus, on gravel banks near the Eastern Branch.
Geodromicus curvus and *Lestera pallipes*, common along water courses.
Acilota subcarinata, not rare under leaves in the fall.
Arpedium schuvarzi, very abundant under old leaves.
Olophrum, like *Arpedium*.
Homalium humerosum and *repandum*, common under old leaves; *diffusum*, in fungi; *fructum*, under moist bark; *hamatum*, on dry leaves of felled trees.
Anthobium concavum, very abundant on flowers in early spring.
Ephelis notata, very common; *guttata*, rare.
Protinus atomarius, very common under old leaves.
Megarthus americanus, in fungi, not common.
Lispinus exiguus, one specimen under bark.
Glyptonus costale, in decaying wood, very common.
Triga picipennis, under bark of various trees.
Eleusis pallidus, found once in great numbers under the bark of an old stump.
Sagoneus americanus, one specimen.
Leucophaea cribrata, one specimen.

ECOLOGICAL NOTES—(continued).

TRICHOPTERYGIDÆ.

Nossidium americanum, found once very abundantly in a much decayed old stump.

Ptilium and *Ptenidium*. Species of these genera occur under old leaves in moist places.

Lamulodes paradoxus, strictly myrmecophilous, among *Lasius claviger*.

Pteryx batteata, in decaying wood.

Ptenellodes leroutei, under old leaves.

Trichopteryx. These species are more or less abundant in all sorts of decayed vegetable matters, several undescribed species.

Smicrus filicornis, under debris near water.

Ptinella quercus and *pini*, under moist bark.

Nephaneus laticulatus, under old leaves.

SCAPHIDIIDÆ.

Scaphidium obliteratum, on the mold-like fungus growing on the underside of logs, rather rare; *quadriguttatum*, with the preceding, abundant.

Cyparium and *Brocera* on moldy old leaves.

Taridium gammaroides, lives like the next.

Scaphisoma, live in fungi and old leaves.

PHALACRIDÆ.

Phalacrus, *Olibrus*, *Litochrus*. All our Phalacridæ occur on various plants, as well as under decaying leaves.

CORYLOPHIDÆ.

Sucium, our species live under bark of various trees; can also be beaten from dead branches.

Arthrolips, *Sericoderus*, under old leaves.

Orthoperus glaber, very abundant on growing vegetation.

COC'INELLIDÆ.

Anisosticta seriata, one specimen; more abundant near salt-water regions.

Megilla maculata, a very abundant species, gregariously under bark and stones in cold weather.

Hippodamia 13-punctata, one specimen; the other species are common.

Coccinella affinis, on pine trees in early spring, on willows in summer; the other species are common.

Adalia bipunctata, abundant in our parks and gardens.

Harmonia picta, rare, on pine trees.

Mysia pullata, exclusively on pine trees.

Anatis ocellata, very abundant everywhere.

Psyllobra 20-maculata, very common on low vegetation.

Chilocorus hirtellus, exceedingly abundant.

Exochomus 3-pustulatus, on oaks, not common.

Cryptognatha pusilla, on shrubbery, very abundant.

Smilia marginata and *misella*, on trees and shrubs, common.

Brachyacantha. The various species are beaten from low plants in meadows.

Hyperaspis. All the species are beaten from trees and shrubs.

Seymus. All species live on trees, shrubs, and low plants.

Cephaloscymnus zimmermanni, on branches, very rare.

Epilachna borealis, very common, feeds on cucurbitaceous plants.

ENDOMYCHIDÆ.

Alexia lobata, a single specimen.

Anamorphus spec.? known in our collections as *A. pusillus* Zimmermanmann Mss.

Symbiotes ulkei and *minor*, live on mold growing within red rotten logs.

Mycetes hirta, on molds in dark places.

Rhania unicolor, very abundant under old bark.

Liestes spec.? very rare, at the base of trees.

Phymaphora pulchella, under old bark.

Lycoperdina ferruginea, in a small species of *Lycoperdon*.

Aphorista vittata, on molds on logs, common.

Mycetina testacea, on fungi growing on roots and logs; *perpulchra*, rare, on mold under bark.

Senotarsus hispidus, on dead branches of various trees.

ECOLOGICAL NOTES—Continued.

Endomychus biguttatus, sometimes in great numbers under loose bark.

EROTYLIDÆ.

Languria. Our species are most frequently found on swampy meadows; *mozardi*, the most common species.

Eurestus punctatus, under old bark infested with fungi.

Dacne 4-maculata, on white fungi, growing on old logs.

Megalodacne, like *Eurestus*.

Ischyrops 4-punctatus, in company with *Dacne*.

Myrotretus sanguinipennis and *pulcher*, in a certain kind of toadstool.

Tritoma. All species live usually in large numbers in toadstools and various fungi.

COLYDIDÆ.

Synchita obscura, found exclusively on red oak; the other species occur under bark of dead branches of various deciduous trees.

Cicones marginalis, one specimen.

Ditoma. The species are found under bark of all sorts of trees.

Coxelus guttulatus, not rare on dead branches.

Lasconotus referendarius, under pine bark in the galleries of Scolytids.

Aulonium and *Colydium*, the species of both genera are found under bark and in twigs of coniferous and deciduous trees.

Aglenus brunneus, introduced from Europe; one specimen found by Mr. Pergande.

Oxytelus americanus, rare.

Penithelipa and *Pycnomerus*, under moist bark of dead pines.

Bothriodes geminatus, very common under dry oak bark.

Bothriodes caratus, very rare.

Cryptus pubescens, under all sorts of bark, very abundant.

Phanorhiza subrotundus, very common in decayed wood.

HYMENOPTERÆ.

Phaenocarpa and *Phaenocarpa*, under bark of decayed wood.

RHYSSODIDÆ.

Rhyssodes and *Clinidium*, both genera found under bark of decayed wood.

CUCUJIDÆ.

Sitranus murinumensis and *advena*, cosmopolitan, common; the others under all sorts of bark.

Nausibius clavicornis, under bark, rare; *repandus*, very rare.

Cutogenus rufus, very common under bark of various trees.

Pedarius depressus, under bark, rare.

Cucujus clavipes, very common under bark of deciduous trees, especially *Larriodendron*.

Ino reclusa, under bark of black locust.

Lamprophorus, species more or less common under bark of various deciduous trees; *schwarzii*, very rare; *angustulus*, in galleries of Scolytids.

Lathropus rervulii, very common on old twigs.

Dysmerus basalis, in branches of *Rhus toxicodendron*, common at Bladensburg.

Brontes dubius, under bark, abundant; *debilis*, one specimen.

Telephanus velox, under old leaves, one of our commonest insects.

CRYPTOPHAGIDÆ.

Telmatophilus and *Loberus*, by sweeping humid meadows.

Tomarus pulchellus, under old leaves, chips, etc., very common.

Antherophagus ochraceus, rare, on flowers, inquilinous in nests of *Bombus*.

Henoticus serratus, the specimens found here may belong to a distinct species, rare.

Cryptophagus. Six species occur in the District, which have not yet been studied.

Cænoscelis. There are seven species found here, which can not be named at present; they occur under old leaves.

Atomaria ephippiata, *distincta*, and *ochracea*. Eight species have been found, among which only these three are named at present.

Atomaria apicalis, very common under old leaves and chips.

ECOLOGICAL NOTES—Continued.

MYCETOPHAGIDÆ.

Mycetophagus punctatus and *flecosus*, very common in various fungi; *obsoletus*, once found in abundance in a white fungus; *pluripunctatus*, in fungi under moldy bark; *bipunctulatus*, in old flour barrels, also on moldy bark; *pini*, under old pine bark; *melsheimeri*, one specimen.

Litargus. All our species are common under decomposing vegetable matter, also under bark.

Typha fumata, like *Litargus*, very common.

Berginus pumilus, one specimen.

Myrmecochorus lathridioides, in old horse manure, in autumn.

Diplocelus brunneus and *rufus*, old branches infested with fungi.

DERMESTIDÆ.

Byturus unicolor, commonly found by beating.

Dermestes caninus, common under carcasses; *lardarius*, common in houses; *rulpinus*, under old bones; *elongatus*, one specimen found under bark.

Attagenus piceus, abundant, especially in houses; *pellio*, one specimen, *hornii*, introduced from Mexico.

Trogoderma and *Anthrenus*, our common house and cabinet pests, also common outdoors on flowers, especially *Spiræa*.

Cryptorhopalum luenorrhoidale and *triste*, very abundant on flowers.

Aspectus hispidus, one specimen.

Orphilus niger, on flowers, rare.

HISTERIDÆ.

Hololepta. The two species are not rare under freshly loosened bark of trees.

Hister. All our species of the genus *Hister* occur in vegetable debris, except the subgenera *Platysoma* and *Cylistix*, the species of which live under bark of deciduous or coniferous trees; *Phelister zeneomicans* is very rare and seems to have not been found elsewhere.

Tribalister marginellus, very rare; only a few specimens have been caught, flying about in early spring.

Tribalus americanus, not rare, under bark and in decaying wood.

Epierus, like *Tribalus*.

Heterius brunnipennis, in nests of *Formica fusca*.

Echinodes setiger, only one specimen found.

Onthophilus alternatus, under fungus or vegetable debris.

Dendrophilus punctulatus, not rare under bark of old trees.

Psomalus. Our species are more or less abundant under old bark of trees.

Inapleus marginatus, under old boards and sticks on the banks of the river.

Saprinus. Of these species *fraternus*, *fitchii*, and *patruelis* are found in sand near the river; all the others occur in various kinds of dung.

Plegaderus transversus, in galleries of *Tomiscus* under pine bark.

Teretrius, *Bacanius*, and *Aceritis*. All species of these genera live under bark of trees.

NITIDULIDÆ.

Brachypterus urticae, on nettles.

Cercus abdominalis, on flowers of *Sambucus niger*.

Carpophilus hemipterus, found in grocery stores; the others live on blossoms and sap of trees.

Colatus. All on exuding sap of trees.

Conotelus obscurus, on flowers of *Convolvulus*; *mexicanus* is introduced into greenhouses.

Epiræa peltoides, rare, on sap of trees; all the others are found under old leaves.

Nitidulu, common under dry carcass.

Stelidota, under dry leaves.

Prometopius 6-maculatus, on sap of trees, common.

Phenolia grossa, in fungi, common.

Omosita colon, under dry animal matter, abundant.

Amphotis ulkei, in ants' nests.

Soronia undulata and *substriata*, on sap of trees, common.

Thalycra concolor, one specimen.

Pocadius helveticus, in *Lycoperdon*, very common.

Ozycnemus, in fungi.

Amphicrosus ciliatus, on sap of trees.

ECOLOGICAL NOTES—Continued.

Pallodes pallidus, in toadstools, abundant.
Cythrampus adustus, in fungus.
Cybocephalus nigrivittatus, on twigs of trees
Cryptarchus and *Ips*. The species of both
genera found on sap.
Pityophagus cephalotes, one specimen on a
fence, south of the Treasury
Rhizophagus, on mold under bark.

LATHRIDIIDÆ.

Holoparamesus kunzei, one specimen
found under bark of an old hickory
tree.
Lathridius liratus, very common under
débris.
Enicmus and *Coninomus*, found on molds.
Corticaria and *Melanophthalmus*, found by
sifting and beating.

TROGOSITIDÆ.

Nemosoma parallelum and *cylindricum*,
parasitic on Scolytids.
Alindria cylindrica and *teres*, on old
branches.
Trogosita virens, very common under
various trees.
Tenebrioides maturitunica, in flour and feed
stores; the other species found under
bark of trees.
Grynocharis quadrilineata, rare, on tree
fungi.
Lycophus villosus, in decaying wood.
Thymalus fulgidus, on tree fungi.

MONOTOMIDÆ.

Monotoma, under decaying weeds.
Hesperobates, *Eurogus*, and *Bactridium*,
under bark of trees.

BYRRHIDÆ.

Noxodendron unicolor, sap of trees.
Byrrhus murinus, in moss.
Syncolypa strigosa, sifted from moss.
Lamachus, along the edge of the river.

PARNIDÆ.

Parnus lecontei, under stones in run-
ning water.
Parnus, two specimens swept
from trees.

Dryops, under stones and debris in run-
ning water.
Elmus, under stones and moss in running
creeks.
Stenelmis, *Macronychus*, and *Ancyronyx*,
like *Elmus*.

HETEROCERIDÆ.

Heterocerus. All the species occur in
mud and sand banks.

DASYLLIDÆ.

Eurygogon niger and *californicus*, on
bushes.
Odontonyx and *Anchytarnus*, in swampy
places.
Ptilodactyla ferricollis, on bushes and low
plants.
Eucinetus, sifted from moldy leaves.
Ectopria nervosa, on plants.
Prionocyphus, *Helodes*, *Scyrtes*, and *Cyphon*.
All the species of these genera live on
plants in swampy places.

RHIPICERIDÆ.

Zenon piceus, under bark of trees.
Sandalus, occasionally found.

ELATERIDÆ.

Melasis pectinicornis, found boring in dead
oak.
Tharops ruficornis, boring in felled trees.
Dellometopus, on bushes, common.
Dromaeolus, beating from dead branches.
Pornax, like *Dromaeolus*, but rare.
Adelothyreus dejunii, one specimen.
Microthagus, all on dead branches.
Hypocerus, like *Microthagus*.
Adelocera, all under loose bark.
Meristhus scobinula, one specimen in a
sandy place near Rock Creek.
Chalrolepidius viridipilis, on fences and
trees.
Alnus oculatus, under bark of various trees;
myops, under bark of pine trees.
Hemirhipus fascicularis, on fences and
trees.
Cardiophorus convexus and *gagates*, beat-
ing from trees and bushes; *cardiaceus*, on
sandy places.

ECOLOGICAL NOTES—Continued.

Horistonotus curvatus, on bushes and trees, common

Esthesopus claricollis, one specimen.

Cryptohypnus choris, on dry sand banks; *melsheimeri* and *perplexus*, on gravel banks; the others swept in meadows.

Anchastus rufus, very rare

Monocrepidius, on meadows and bushes; *auritus* and *bellus* very common under stones in early spring.

Dicrepidius and *Ischiodontus*, both very rare, on bushes.

Eluter. All the species are found under bark and by beating dead branches

Drasterius elegans and *amabilis*, mostly under stones, very abundant.

Megapenthes, on bushes.

Ludius, under bark.

Agriotes and *Dolopius*, on bushes.

Glyphonyx, on bushes, very common.

Melomatus, *Linonotus*, *lithous*, *Sericosomus*, *Corymbites*, *Hemicrepidius*, and *Melanactes* are all more or less frequent in old stumps, under bark and stones, or beaten from various bushes; *Leptoschema bicolor* is very rare; *Sericosomus viridanus*, under chips and stones in early spring; *Melanactes reichei*, only two specimens.

Perothops murida, from old beech trees.

Cerophytum pulsator, three specimens found under chips and stones in early spring.

THROSCIDÆ.

Drapetes geminatus, under rotten bark and on dead branches.

Aulonthroscus and *Throscus*, under old leaves and plants.

BUPRESTIDÆ.

Chalcophora virginiensis, in pines; *campestris*, on sycamore.

Dicercu, on various deciduous trees.

Pecilomota debilis, very rare.

Buprestis rufipes, on oak; the other species on pines.

Cnyra gracilipes, on oak.

Melanophila, all on pines.

Anthazia, all on various deciduous trees.

Chrysobothris fenorata, *pusilla*, *azurea*, and *scitula*, on various deciduous trees; *floricola*, *denticipes*, *6-signata*, *harrii*, on pines.

Actenodes acornis, rare.

Acmaodera ornata and *culta* on flowers.

Prosimu gibbicollis, on black locust.

Mustogenius, on oaks.

Eupristocerus cogitans, on elder bushes.

Agrius cyticollis, on different kinds of

Rubus; *otiosus*, on oak and hickory;

arcuatus, on hazel; *bilmentus*, on chest-

nut and honey locust; *pubis*, on oak;

egenus, on black locust; *obsoletus* and

granulatus are rare

Rhaebocelis tenuis, on oaks.

Taphrocerus gracilis, very common on plants in swampy meadows

Brachys, all on oak bushes

Pachyscelus purpureus. The larva mines the leaves of *Lespedeza*.

LAMPYRIDÆ.

Culopteron terminale and *reticulatum*, both common.

Celetes basalis, not common.

Ctena dimidiata, rare.

Eros, *Plateros*, and *Chlochromus*, on flowers and bushes.

Lucidota, like the preceding.

Ellychnia corrusca, very common about trees and bushes.

Pyropyga and *Pyraustomema*, like *Ellychnia*.

Photinus pyralis, our commonest firefly.

Photuris pennsylvanica, very abundant.

Phengodes spec.?, a single female specimen has been found.

Tythythyr erythrocephala, common on bushes.

Omethes marginatus, rare, beaten from bushes.

Chauliognathus, very common on blossoms and flowers.

Podabrus tricostratus and *basilaris*, rare; the others common.

Silis percomis and *spatulata* are both rare.

Dilenus bidentatus, very common on clover.

Telephorus. All species are on low plants and bushes.

Polemia laticornis, on meadows.

Trypherus latipennis, common on bushes.

Malthinus and *Malthodes*, on bushes and grasses in meadows.

ECOLOGICAL NOTES—Continued.

MALACHIIDÆ.

Collops, more or less common in meadows, chiefly on clover.
Chytocactus setosus, on branches of oak.
Anthocomus Pseudebæus, and *Attalus*. All the species of these genera are found on grasses, flowers, and bushes.

MELYRIDÆ.

Allyneris cribrata, chiefly found on chestnut blossoms.

CLERIDÆ.

Elasmocerus terminatus, found on trees infested with Scolytids and Bostrychids.
Cymatodera, on dead branches.
Trichodes apivorus, on flowers of *Spiræa*.
Clerus quadriguttatus, on pine; *rosmarus*, on flowers; *ichneumoneus* and *thoracicus*, on branches of deciduous trees.
Thanasimus dubius, on pine.
Thanoeroclerus sanguineus, under bark of deciduous trees; *tantillus*, one single specimen found.
Hydnocera, all species occur in meadows and on bushes.
Phyllobanus dislocatus, on dead branches.
Ichneia laticornis, lives parasitic on *Phæosinus dentatus*.
Chariessa pilosa, on dead branches of deciduous trees.
Cregya, like *Chariessa*.
Orthopleura damicornis, on branches of oak.
Necrobia, all on dried animal matter.

DERODONTIDÆ.

Derodontus maculatus, on mold under loose bark of trees.
Loricobius erichsoni, found many years ago on pine in the Smithsonian grounds.

PTINIDÆ.

Gibbium psyllodes, one specimen found on the wall of the United States Treasury building.
Blattella and *brunneus*, in houses; *quadrimaculatus* and *interruptus*, one specimen each in white rotten oak.

Eucrada humeralis, on bushes.
Ernobius mollis, on old woodwork; the others beaten from pine branches.
Ozognathus floridanus, two specimens beaten from bushes.
Oligomerus, all on dead branches.
Sitodrepa panicea, everywhere, in houses.
Hadrobregmus, beaten from dead branches.
Trichodesma gibbosa, in old branches.
Anobium notatum, on old oak branches.
Trypophytus sericeus, on old branches.
Petalium bistriatum, very common on dead branches.
Theca, *Eupactus*, and *Xyletinus*, all on old twigs.
Lasioderma serricorne, in drugs and tobacco.
Hemiptychus, all species on dead branches.
Protheca hispida and *puberula*, in old rotten wood, common.
Dorcatoma, all in dead branches.
Cenocara oculata, in *Lycoperdon*.
Ptilinus ruficornis, boring in old wood.
Endecatomus rugosus, in old timber.

BOSTRICHIDÆ.

Most of the *Bostrychidæ*: *Stephanopachys*, *Lichenophanes*, *Xylobiops*, etc., bore in dead twigs or are found under loose bark. *Dinoderus* and *Rhizopertha* are importations.

LYCTIDÆ.

Lyctus and *Trogoxylon*, both in old woods.

CUPESIDÆ.

Cupes concolor, on old wood.

LYMEXILIDÆ.

Lymexylon sericeum, boring in old oak wood.
Micromalthus debilis, one specimen found in the city.

OTIOIDÆ.

Oti. All species live in fungi growing on logs and stumps; quite a number of species are not determined yet.

ECOLOGICAL NOTES—Continued.

Ennearthron thoracicornis, like *Cis*, several undetermined species
Ceraxis mellei, like *Ennearthron*.
Rhipidandrus paradoxus, in a white fungus at the base of trees.

SPHINDIDÆ.

Sphindus americanus, in fungi growing on timber.

LUCANIDÆ.

Lucanus elaphus, one specimen said to be found in Washington; *dama*, not rare at electric lights.
Dorcus parallelus, in white rotten wood.
Platycerus and *Ceruchus*, like *Dorcus*
Necrus obscurus, on sand banks along the Eastern Branch

PASSALIDÆ.

Passalus cornutus, boring galleries in old stumps and logs.

SCARABÆIDÆ.

Canthon leviss and *vigilans*, common in dung; *viridis*, under old leaves.
Chæridium histeroides, in decaying fungi.
Copris, all in dung.
Phænus carnifex, in human excrements.
Onthophagus hecate, *tuberculifrons*, and *pennsylvanicus*, in dung; *junus* and varieties, in decaying toadstools and fungi.
Aphodius. All species of this genus live in various kinds of dung; only *serreni* is found under old leaves, and *oblongus* in hollow trees.
Dialytes truncatus and *striatulus*, in horse manure.
Atenius, all species found in rich grounds; *figurator*, found at electric light.
Rhyssomus scaber, under stones in wet sandy places.
Pleurophorus cæsus, in rich soil; *ventralis*, one specimen.
Psammophilus interruptus, in sandy places along the river; *agialioides*, one specimen.
Ægialia, one undescribed specimen.
Ochodæus musculus, one specimen.
Bolbocerus, found occasionally in roads.
Odontæus cornigerus, like *Bolbocerus*.

Grotripes, all in rotten fungi and dung; *hornii*, under the stem of a toadstool, also at electric lights.

Cleonus aphodoides, in rotten wood.

Trox, all the species are found in dried carcasses of mammals and birds, also at electric lights

Hoplia, found flying on sandy soil.

Dichelomycha, on bushes.

Serica vespertina, very common under stones and logs in spring; *iricolor* and *sericea* on bushes; *tricolor*, rare.

Macroclactylus rubripinosus, the well-known rose chafer.

Diplosternus, the species are all found under stones and on bushes.

Lachnosterna. There are 26 species in the District. All are found on trees at night, or attracted by lights.

Anomala marginata, on grapevine; the others all on pine.

Strigoderma, the two species are on blossoms of *rubus*.

Pelidnota punctata, common on grapevine.

Cotalpa lanigera, on cottonwood trees.

Cyclocephala, flying after dusk.

Chalepus trachypygus, on muddy grounds along the river, and abundant at electric lights.

Ligyrrus, in moist sandy places.

Aphonus, in old decayed stump of trees.

Xyloryctes satyrus, larva very abundant under stones in pastures.

Strategus antæus, in rotten wood.

Dynastes tityus in rotten wood, not common.

Philenus vulgaris, one specimen dug out from the ground.

Allorhina nitida, extremely abundant in spring.

Euphoria inda, very abundant in early spring; *areata* in sandy roads; *herbacea* on bushes; *fulgida* and *sepulchralis* on blossoms.

Cremastochilus leucostictus, one specimen occurred at Odenton, Maryland. All the others are found in nests of various ants, also flying on roads.

Osmoderma eremicola and *scabra*, in rotten trees.

ECOLOGICAL NOTES—Continued.

Gnorinus maculosus, on blossoms, very rare.

Trichius, all species are found on flowers and blossoms.

Valgus, in decaying chestnut trees.

SPONDYLIDÆ.

Parandra brunea, under bark of old deciduous trees.

CERAMBYCIDÆ.

Orthosoma brunneum, under loose bark.

Prionus, like *Orthosoma*.

Sphenostethus taslei, not common on bushes.

Asemum mæstum, on pine.

Criocephalus, frequently met with in lumber yards.

Smodicum cucujiforme, abundant under bark.

Hylotrupes bajulus, on posts, lumber, etc.; *ligneus*, on juniper.

Phymatodes varius, in oaks; *amœnus*, in grapevine.

Callidium, all common on pine.

Ceue rigida, on juniper.

Gracilia minuta, on twigs of trees.

Chion cinctus, in hickory and oak.

Eburia quadrigeminata, in lumber yards and attracted by light.

Ronuleum atomarium and *rufulum*, both not common.

Elaphidion villosum, extremely abundant; *mucronatum*, common, *unicolor*, less common; *subpubescens* and *cinerascens*, rare.

Tylonotus bimaculatus, rare, a specimen found at electric light.

Heterachthes quadrimaculatus and *eburnus*, both rare.

Curtius, *Phyton*, *Obrium*, beaten from branches and twigs.

Callimacrus sanguinicollis, on flowers.

Molorchus bimaculatus, on blossoms.

Rhopalophorus, on flowers.

Tragidion coquus, rare.

Purpuricenus humeralis, on hickory and oak; *axillaris*, rare.

Batyde suturalis, very common on flowers.

Symphorus notatus, on various trees.

Gylone pictus, on hickory in spring; *robustus*, very common on solidago in autumn.

Calloides nobilis, rare.

Arhopalus fulminans, rare.

Cytus marginicollis, not common.

Xylotrechus colonus, very common; *scutellatus*, in pine; *quadrimaculatus*, rare.

Neocyrtus, on flowers and running on trees.

Clytanthus ruricola and *albofasciatus*, both rare.

Microcyrtus gazelluli, one specimen.

Cyrtophorus ferrucosus, common on flowers.

Tillomorpha geminata, bred from sumac.

Eudercus picipes, very common on flowers; *pini*, in lumber yards.

Atimia confusa, not common on juniper.

Distenia undata, in grapevine.

Desmocerus palliatus, on sambucus.

Necydalis mellitus, one specimen.

Encyclops ceruleus, on flowers.

Rhagium lineatum, very common under pine bark.

Centrodera decolorata and *picta*, of both single specimens.

Trox trivittatus, one specimen.

Armrops directa, not common; *discoides*, one specimen.

Gaurotes cyanipennis, on blossoms.

Strangalia and *Typocerus*, all on blossoms.

Leptura, all on blossoms and flowers; *marginata*, very rare; *hamatites*, *circundata*, *pubera*, are rare; *lineola*, *nitens*, *vittata*, *vagans*, *cordifera*, *proxima*, are common; of *subhamatus* and *mutabilis*, single specimens.

Euryptera lateralis, rare.

Cyrtinus pygmaeus, common on trees and bushes.

Peenocerus supernotatus, common on various deciduous trees.

Monohammus, on pine; also in our lumber yards.

Dorcaschema wildii, on osage orange; *alternatum*, on mulberry and osage orange; *nigrum*, rare.

Helamis cinerea, on mulberry and hickory.

Cacoplia pullata, one specimen.

Goes tigrina, *pulverulenta*, *oculata*, and *tessellata*, on bushes; *pulchra*, on hickory; *debilis*, on white oak.

Plectrodera scalator, on willow; two specimens near the Free Bridge.

ECOLOGICAL NOTES—Continued.

- Acanthoderes quadrigibbus*, rather rare; *decipiens*, very common; *morrissi*, very rare.
- Leptostylus* and *Liopus*, all on old twigs and dead branches.
- Dectes spinosus*, common on various weeds.
- Lepturges*, like *Leptostylus*
- Hyperplatys*, like the preceding
- Trographis fasciata*, on deciduous trees.
- Ceratographis pusillus*, in pine trees.
- Acanthocinus obsoletus* and *nodosus*, in pine.
- Pogonocherus mixtus*, in pine, rare.
- Ecyrus dasyceus*, very common on deciduous trees.
- Eupogonius tomentosus*, not rare on pine; *vestitus*, on bushes; *subarmatus*, rare on beech.
- Oncideres cingulata*, on persimmon.
- Atura crypta*, on old branches.
- Hippopsis lemniscata*, on weeds.
- Superda obliqua*, on alnus; *candida*, on apple trees; *tridentata* and *vestita*, on elm; *lateralis*, on willows; *puncticollis*, on *Rhus toxicodendron*.
- Otherea himaculata*, on rubus; *3-punctata*, on solidago; *ocellata*, and *gracilis*, rare; *ruficollis*, on sumac and sassafras.
- Tetrops monostigma* and *jucunda*, on meadows.
- Tetraopes tetraophthalmus*, on *Asclepias cornuti*; *canteriator*, on an orange-colored *asclepias*; *5-maculatus*, on specimen.
- Amphionycha flammata*, on bushes.
- Dysphaga tenuipes*, in hickory; *lavis*, one specimen.
- Crioceris asparagi* and *12-punctata*, on asparagus, imported.
- Anomaea laticlavia*, common on robinia.
- Cosmoptera dominicana*, on bushes and herbs.
- Babia* and *Saxinis*, on meadows.
- Chlamys*, larva on sycamore.
- Exema gibber* and *conspersa*, in meadows and on shrubs.
- Bassarus* and *Cryptocephalus*. All species of these genera live on various flowers and bushes; only *schreibersii* on pine.
- Griburius equestris*, on wild roses.
- Pachybrachys*, like *Cryptocephalus*; *tridens*, on *Rhus toxicodendron*; there are some unrecognized forms.
- Monachus*, *Diachus*, *Triachus*, all on bushes and plants in meadows; *Diachus leris* and *Triachus rufus* are rare.
- Fulia rufida* and *longipes*, common on grapevine
- Xanthonia*, very common on various bushes.
- Myochorus denticollis*, by sweeping meadows.
- Glyptocelis pubescens* and *barbata*, common on pine.
- Graphops*, in meadows, especially on clover.
- Typophorus cunctus* and varieties, very common in meadows; *viridicyaneus*, rare.
- Metachroma*, on bushes, especially oak.
- Chrysochus auratus*, common on apocynum.
- Tymnes tricolor*, common on bushes.
- Colaspis*, common on meadows and bushes.
- Rhabdopterus picipes*, like *Colaspis*.
- Nodonota*, on flowers and bushes.
- Chrysodina*, like *Colaspis*, very common.
- Prasocuris varipes*, on swampy grounds.
- Labidomera clivicollis*, on *Asclepias incarnatu*.
- Leptinotarsa deremlineata*, the well-known potato beetle; *juncta*, has disappeared from our fauna since the arrival of *deremlineata*.
- Zygogramma* and *Calligrapha*, all on meadows and weeds.
- Plagioderus viridis*, very common on cruciferous plants.

CHRYSOMELIDÆ.

- Donacia cincticornis*, *palmata*, and *piscatrix*, on aquatic plants; the others on swampy meadows; the only specimens of *hypoleuca* were found at electric light.
- Hamonia nigricornis*, in swamps on water plants.
- Orsodacta atra*, on willow blossoms in early spring.
- Zeugophora puberula*, on poplar.
- Syneta ferruginea*, rare.
- Lema sayi*, on *Commelina virginica*, along the Potomac Flats; *trilineata*, on potatoes; *6-punctata* and *brunnicollis*, in meadows.

ECOLOGICAL NOTES—Continued.

Gastroidea cyanea, on rumex.
Lima lapponica and *scripta*, on willows.
Monocasta coryli, on elm, rare.
Trirhabda tomentosus, rare; *virgata*, one specimen.
Galerucella americana, on solidago; *rufosanguinea*, on *Azulea nudiflora*; *nymphææ*, on nymphææ and other aquatic plants; *decora*, on willows; *notata*, on eupatorium; *xanthomelæna*, on elm.
Diabrotica, *12-punctata* and *vittata*, common everywhere; *atripenus*, rare.
Phyllotroctis discoides and *limbata*, on swampy grounds.
Luperodes meraca and *cyaneus*, on meadows.
Phyllechthrus dorsalis and *gentilis*, on lespedeza.
Ceratomyia trifurcata, common on bushes and meadows.
Blepharidus rhois, on rhus.
Pachyonychus paradoxus, on smilax.
Hypolamps pilosus, not rare.
Edionychis, more or less common by beating meadows; *riana*, very common; *indigoptera*, one specimen.
Disonycha, like *Edionychis*; *5-vittata*, one specimen.
Sphaeroderma opima, several specimens by sweeping.
Haltica chalybea, on grapevine; *fuscicornis*, on renothera; *ignita*, everywhere in bushes; *amana*, rare; *mareragana*, one specimen.
Lactica iris and *tibialis*, both rare.
Diphaulaca bicolorata, rare.
Orthaltica copalina, very common on sumac.
Crepidodera rufipes, on black locust; *helixina*, very abundant on willows; *atriensis*, abundant on meadows.
Epitrix, very abundant on various low plants; *pavula*, on solanum.
Mantura floridana, swampy meadows.
Chatocnema, all on meadows; *subcylindrica* and *protensa* are rare.
Systena, all on bushes and lower plants.
Glyptina, by sweeping meadows.
Aphthona insolita, very rare.
Phyllotreta, all on cruciferous plants, except *picea*.
Phyllotreta, all by sweeping meadows.

Dibolia borealis, on plantago.
Psylliodes conrevar, on low plants.
Microthopala vittata and *serena*, live on solidago; the others are rare; *melshemeri*, very rare.
Odonotoma scapularis and *bicolor* on meadows; *dorsalis*, on black locust, *nerrosa*, everywhere on bushes; *horui*, very rare.
Churistena aradne, one specimen.
Orotoma pleutula, on *Tecoma radicans*.
Stemospa metallica, on swampy meadows.
Cassida nigripes on convolvulus, *hirtata*, on potatoes.
Ophioclypea clavata, on oak; the others mostly on convolvulus.
Chelymophra argus, common on convolvulaceæ.

BRUCHIDÆ.

Spermophagus robinii, on *Gleditsia triacanthos*.
Bruchus pisorum, in peas, imported; *chinensis* and *4-maculatus*, both imported; *hiruhieratus*, in seeds of *Cassia marylandica*; *distinguentus*, on *Ludwigia alternifolia*; *oleuletus*, in seeds of *Tephrosia virginiana*; *obtectus* in beans; *hibisci*, in seeds of *Hibiscus moscheutos*; *exiguus*, in seeds of *Amorpha fruticosa*; of *calrus* and *perforatus*, single specimens.
Zabrotes oblitteratus and *subnitens*, rare, habits unknown.

TENEBRIONIDÆ.

Epitragus arundinis, on bushes.
Phelopsia obscurata, under old bark, one specimen.
Blaps similis, said to be found in Alexandria, Virginia.
Polypleurus geminatus, under stones and chips.
Nyctobates pennsylvanica, abundant under loose bark.
Merinus laevis, like *Nyctobates*.
Haplodrus femoralis and *ater*, under loose bark.
Scotobates calcaratus, common under bark.
Xylopinus, under bark; *senescens*, rather rare.
Tenebrio obscurus and *molitor*, introduced species; *castaneus* and *tenebrioides*, under loose bark.

ECOLOGICAL NOTES—Continued.

Opatrinus notus, very common under stones.

Blapstinus, under stones and chips in sandy places

Tribolium ferrugineum and *confusum*, under bark, introduced.

Lyphus piceola, rare.

Diedus punctatus, very common under bark.

Echocerus murillosus and *dentiger*, both imported.

Aphidobius diaperinus, common, imported.

Uloana, all in rotten wood.

Eutorchia picea, under stones and in moss

Anachis brunneus, exceedingly common under old leaves

Paratenetus, very common on dry leaves.

Pratensis fuscus, in rotten wood, rare

Diaperis hydni, in fungi, abundant.

Arrhenoplita bicornis and *viridipennis*, on various fungi.

Platydemia. The species of this genus live all under bark infested with fungi; *ruficollis*, rare.

Phylethrus bifasciatus, in fungus.

Putorius ratzeburgi and *subdepressus*, in seeds, imported.

Hypophthalmus, parasitic on Scolytids; *piliger*, rare.

Pentaphyllus pallidus, in fungus.

Buletotherus bifurcus, in hard fungi growing on trees.

Byletophagus corticola, under old bark.

Helops micans, *americanus*, and *areus*, at the base of trees; *venustus*, on dead branches of oak.

Meracantha contracta, on old trees.

Strongylium tenuicollis and *terminatum*, in rotten wood.

LAGRIIDÆ.

Arthromacrus wena, common on bushes.

Statira, like *Arthromacrus*.

MONOMMIDÆ.

Hyperhagus punctulatus, common on chestnut logs.

MELANDRYIDÆ.

Tetratoma tessellata, on rotten twigs; *truncorum*, rare.

Psenus humeralis, in fungi, not common.

Penthe, in fungi growing on logs and stumps.

Synchroa punctata, very common under bark.

Eustrophus and *Holostrophus*, in fungi.

Orchesia, in hard fungi growing on trees.

Hallomenus, on fungi

Microscapha clavicornis, common on dead twigs.

Melandrya, under old bark.

Carebura longula, on pine twigs; one specimen.

Spilotus 4-pustulosus, common on twigs.

Enchodes sericea, from a felled old tree; one specimen.

Mystaria simulator, under bark.

Hypulus lituratus, common on moss growing on trees; *concolor*, rare; *rundoueri*, one specimen.

Symphora flavicollis and *rugosa*, both common everywhere.

Anisotrypa glaucula, on dead twigs.

Scraptois sericea, very common on blossoms.

Allopeda lutea, on flowers.

Canifa, very common on bushes.

Nothus rarians, on *Crataegus*.

Mycteris scaber, on flowers.

PYTHIDÆ.

Borus unicolor, under pine bark, once found across the Free Bridge.

Pytho americanus, under bark of stumps, rare.

Salpingus virescens, rare, two specimens.

Rhinosimus viridiannus, one specimen.

CEDEMERIDÆ.

Microtmus sericans, very common on bushes.

CISTELIDÆ.

Allecula atra and *punctulata*, on dry twigs.

Hymenorus, on bushes and dead branches.

Cistela brevis and *marginata*, on flowering trees.

Isomira, on flowers and bushes.

Myetochares, on old wood, but rare.

Chromatia amena, rare.

Capnochroa and *Androchirus*, on bushes and old twigs.

ECOLOGICAL NOTES—Continued.

Nacerdes melanura, everywhere in the city.

Oecalis, *Probosca*, and *Asclera*, all on flowers.

MORDELLIDÆ.

Pentaria trifasciata, on flowers, common.

Anaspis flavipennis and *rufa*, on flowers.

Tomoxia lineella on old twigs; *inclusa*, one specimen.

Mordella, all the species live on bushes and flowers.

Mordellistena. The very numerous species of this genus live partly on flowers, partly on dead twigs.

ANTHICIDÆ.

Stereopalpus mellyi, on bushes near water.

Corphyra, on flowers in swampy localities.

Xylophilus melsheimeri, *basalis*, *nebulosus*, and *fasciatus*, on bushes; *subfasciatus*, under old leaves and bushes; *brunni-pennis*, under bark of sycamore; *notatus*, rare; *impressus*, on pine.

Macratria confusa and *murina*, on bushes near water, very common.

Notoxus anchora, *monodon*, on flowers and bushes, very common; *bicolor*, under old leaves, very abundant.

Mecynotarsus candidus, on sand banks near Eastern Branch.

Anthicus. The numerous species live either on flowers or on the banks of the river.

PYROCHROIDÆ.

Ischalia costata, in white rotten wood, rare.

Pyrochroa flabellata and *femorata*, under chips of wood.

Dendroides canadensis, under bark of trees.

MELOIDÆ.

Meloe, all species are crawling around in early spring.

Tricrania sanguinipennis, found in Rock Creek Valley on gravelly grounds.

Nemognatha nemorensis and *cribraria*, on flowers of solidago.

Zonitis bilineata, on flowers.

Hornia minutipennis, in clay banks inhabited by *Anthophora abrupta*.

Macrobasis unicolor, on solidago and potatoes.

Epicauta pennsylvanica and *cinerea*, on solidago and solanum; *pittata* and *lenniscuta*, on potatoes; *strigosa*, on flowers; *trichrus*, on convolvulus.

Pyrotus germari and *limbalis*, on solidago.

Pomphopaea tena, on willows.

RHIPIPHORIDÆ.

Pelerotoma flavipes, rare.

Rhipiphorus, all on flowers.

Myodites fasciatus and varieties, on solidago and sumac.

STYLOPIDÆ.

Xenos peckii, parasitic on polistes.

RHINOMACERIDÆ.

Rhinomacer pilosus and *elongatus*, very common on dying pine trees.

RHYNOCHITIDÆ.

Auletes cassandrae, on bushes.

Eugnaptus angustatus and *collaris*, on sycamore and other trees.

Rhynchites, on various bushes, mostly oak.

Pterocolus oratus, on oak bushes.

ATTELABIDÆ.

Attelabus, mostly on oak bushes.

OTIORHYNCHIDÆ.

Epicærus imbricatus, common on dry meadows.

Hormorys undulatus, rare.

Panscopus erinaceus, wild grapevines, June, July.

Phyxelis rigidus, under stones.

Otiurhynchus sulcatus, one specimen in Oak Hill Cemetery; *oratus*, two specimens.

Cercopeus chrysorrhæus, in early spring, under chips and stones.

Tanymecus confertus, on dry meadows; common.

Pandeletejus hilaris, extremely abundant on branches and bushes.

Brachystylus acutus, exclusively on persimmon.

ECOLOGICAL NOTES—Continued.

Aphrastus tenuitarsis, on hazel and other bushes.

CURCULIONIDÆ.

Sitona flavescens and *hispidulus*, very common on clover.

Ithycerus northamericus, on hickory.

Apon. All species occur on dry or moist meadows, on shrubs and bushes; only a few of them have been bred, and the food plants of these have been repeatedly recorded.

Podapion gallicola, bred from its gall on *Pinus rigida*.

Phytonomus comptus, on meadows; *punctatus*, is the well-known imported clover-leaf beetle.

Listronotus, all the species are found on sandy and muddy grounds near water.

Macerops, like *Listronotus*.

Pissodes strobi, common on pine.

Pachylobius and *Hyllobius*, like *Pissodes*.

Eudocimus munnerheimi, rare.

Lixus, all occur on rather low meadows.

Dorytomus brevicollis, on poplar.

Pachyphanes amarus, on Cuscuta.

Smicronyr. All the species are found by sweeping on meadows.

Promecoturus gibbistris, like *Smicronyr*.

Phyllotrox ferrugineus, on bushes.

Brachybanus, *Onychilis*, *Endalus*, *Tanyphyrus*, *Lissorhoptrus*, and *Bugorus*, all these genera are found on palustral plants.

Otidoccephalus. Our species are inquilinous in Cynipid galls.

Magdalis olivacea, on hickory; *perforata* and *hispidula*, on pine; *punctata* and *pallida*, on elm.

Tachypterus quadrigibbus, on Cratægus and apple.

Anthonomus gulalis, in pods of cassia, *mutabilis* in wild plum; *symplicata*, inquilinous in willow galls; *juniperinus*, in the juniper fungus; *moleculus*, on solidago; *ungularis*, in *Cassia marylandica*; *signatus* in *Fragaria* and roseaceous plants.

Pseudanthonomus crataegi, on cratægus.

Xanthus pygmaeus, on juniper.

Elleschus ephippiatus, on willow.

Acalyptus carpini, on willow blossoms.

Orchestes salicis, *niger*, *pallidicornis*, on willows; *betuleti*, on *Betula nigra*.

Prionomerus calceatus, on sassafras.

Piazorhinus scutellaris, very common on bushes; *pictus*, rare.

Thysanocnemis halophilus and *fragrans*, in seeds of *Fraxinus*.

Plocetes ulmi, on *Cephalanthus occidentalis*.

Gymnetron teter, on verbascum.

Miarus hispidulus, on *Lobelia siphilitica*.

Laemonacmus plagiatus, on oak bushes.

Cronotrichus juglandis and *elegans*, on hickory; *crataegi*, on cratægus; *nemophilus*, on plum; *tuberosus*, on urtica; *fissunguis*, on hibiscus; *anaglyphicus*, under moist bark and various bushes, very common; *hispidus*, rare.

Rhyssomatus lineaticollis, in the pods of asclepias.

Chalcodermus collaris, rare.

Microhyus setiger, on dead branches.

Acanthopneuste rigida, in red-rotten wood.

Acalles, all under decaying leaves.

Tyloderma foreolatum, in stems of *Enothera biennis*; *fragariae*, on fragaria; *areum*, on plants growing in bogs.

Phydrinus undatus, on *Solanum nigrum*.

Cryptorhynchus. All species are on dead twigs.

Piazurus oculatus, on bushes, very common.

Copturus binotatus, on *Gleditsia triacanthos*; *quercus*, on oak; *longulus*, in podapion galls; *minutus*, on oak.

Acanthopneuste mutabilis, common on dead branches.

Tachygonus lecontei, on oak; *tardipes*, rare.

Mononychus rufipennis, on iris.

Crayonius inaequalis, on grapes.

Acanthopneuste curtus and *acephalus*, common on polygonum.

Aulites, all on swampy meadows; *nebulosus* and *asper*, rare.

Pelonomus cristatus, one specimen.

Acallodes ventricosus, rare.

Cryptorhynchus rapae, on lepidium and other cruciferous plants; the other species all live on plants in marshy ground.

Cylindrogonus zimmermanni, on swampy places.

Perigaster retusus, like *Cylindrogonus*.

ECOLOGICAL NOTES—(Continued)

Pelenomus sulcicollis, on polygonum.
Rhinoncus pericarpus, *pyrrhopus*, and *longulus*, all on polygonaceous plants.
Baris, the species are obtained by sweeping meadows.
Plesiobaris T-signum and *disjuncta*, in swampy meadows.
Glyptobaris, *Onychobaris*, and *Aulobaris*, all are obtained by sweeping marshy meadows.
Ampelogypter ater and *Madarellus*, on ampelopsis.
Desmoglyptus crenatus, on wild grape.
Pseudobaris pectoralis and *nigra* on meadows.
Trichobaris trinotata, on potatoes.
Centrinus. All live on flowers, especially in the fall.
Centrinopus, *Nicentrus*, *Limnobaris*, *Oligolochus*, *Idiostethus*, and *Stethobaris*, all these genera live on various herbs and weeds in meadows.
Ziglyptus striatus and *sulcatus*, in dead twigs.
Oomorphidius laevicollis, one specimen.
Barinus cribricollis and *curticollis*, rare.
Barilepton filiforme, in swampy meadows.
Plocamus hispidulus, breeds in dead twigs of *Robinia pseudacacia*.
Balaninus. The habits of these species have repeatedly been placed on record.

BRENTHIDÆ.

Eupalis minuta, under loose bark of various trees.

CALANDRIDÆ.

Rhodobænus 13-punctatus, very common on meadows.
Sphenophorus. The species live on the roots of grasses in sandy places; *ochreus*, *melanocephalus*, *sculptilis*, and *parvulus* are very abundant.
Culandra oryzae and *granaria*, in stored rice, wheat, corn, etc.
Dryophthorus corticilis, very common under bark of rotten trees.
Himantium errans, under bark; *conicum*, in bark of *Liriodendron tulipifera*.
Cossonus impressifrons, under bark of various trees.

Stenomimus pallidus, under bark, rare.
Phleophaqus apionides and *minor*, on dead twigs.
Wollastonia querricola, like *Phleophaqus*.
Amaurorhinus nitens, on dead branches of grapevine.
Hexarthrum ulkei, rare, seems to be imported.
Rhyncolus oregonensis, rare.
Stenoscelis brevis, common in rotten wood.
 There are several underscribed *Calandridæ*.

SCOLYTIDÆ.

Scolytus quadrispinosus, on hickory; *muticus*, on celtis; *rugulosus*, on fruit trees.
Chramesus icoriae, in branches of hickory.
Phlaeotribus liminaris, on fruit trees; *frontalis*, on *Morus rubra*.
Hylesinus aculeatus, under bark of ash; *opaculus*, under elm bark; *fasciatus*, rare, infests twigs of *Fracinus*.
Cnesinus strigicollis, on liquidambar.
Phloeosinus dentatus, under bark of juniper.
Curphohorus bifurcus, under pine bark.
Dendroctonus terebrans, under pine bark; *frontalis*, one specimen.
Hylastes, all on pine; also *Hylurgops pinifex*.
Crypturgus alutaceus, on pine.
Cryphalus rigidus, on beech, one specimen.
Coccotrypes dactyliperda, found occasionally in dates in our fruit stores.
Hypothenemus eruditus and *dissimilis*, found abundantly in dry twigs of various trees in early spring.
Pityophthorus minutissimus, under oak bark; *pulicarius*, *pultus*, *puberulus*, *annectens* and *hirticeps*, on pine; *consimilis*, on rhus.
Pityogenes plagiatas, on pines.
Xylocleptes decipiens, rare.
Tomicus. All under bark of pines.
Dryocetes granicollis, rare.
Micracis suturalis and *opacicollis* boring in old twigs; *rudis*, in willow, rare.
Thysanoes fimbriicornis, in dead hickory twigs.
Gnathotrichus materianus and *asperulus*, in pine.

ECOLOGICAL NOTES—Continued

Xyleborus tachygraphus, bores in *Acer dasycarpum* and other trees, on the shore of the river; *dispar*, in apple; *celsus*, in hickory; *biographus*, male of *celsus*; *fuscatus*, very common in oak; *planicollis*, probably male of *fuscatus*; *retusicollis*, probably male of *pubescens*; *xylographus*, abundant on oak.

Xyloterus scabricollis, rare; *politus*, common, bores in *Acer dasycarpum*.

Corthylus punctatissimus, common in the roots of *Vaccinium corymbosum*.

Monarthrum fasciatum and *mali*, very abundant in deciduous trees.

Platypus flavicornis and *quadridentatus*, mostly boring in pine.

ANTHRIBIDÆ.

Eurymycter fasciatus, on old branches.

Tropideres bimaculatus and *rectus*, on dead twigs.

Hormiscus, *Torotropis* and *Eusphyrus*, all common on old twigs.

Piezocorynus dispar, *mæstus* and *mutus*, on old logs and under loose bark; *mutus* rather rare.

Anthrribus cornutus, not rare on dead branches.

Cratoparis lunatus and *lugubris*, in fungi growing on old logs; *lunatus*, exceedingly common; *lugubris*, rare.

Brachytarsus alternatus and *variegatus* very common on meadows; *tomentosus*, very common on ambrosia.

Anthrribulus rotundatus, on swampy meadows, common.

Choragus, not rare on dead twigs.

Euxenus punctatus, on twigs, rare.

NEW DIPTERA FROM NORTH AMERICA.

By D. W. COQUILLETT,
Custodian, Section of Diptera.

The present paper is based primarily on a series of specimens collected by Mr. H. S. Barber, who, as assistant to Mr. E. A. Schwarz, accompanied the latter on a collecting trip to portions of New Mexico and Arizona during the past summer. The object of this expedition was to obtain specimens of Coleoptera, and the collecting of the Diptera was therefore a digression from the real object for which the trip was planned. The Diptera thus secured are almost without exception in first-class condition, and form by far the most valuable collection in that order that the United States National Museum has acquired during the past year. Owing to pressure of other duties only a portion of the collection has as yet been worked up, but even this portion has yielded many new and interesting forms which it is deemed advisable to make known at as early a day as possible, and they are therefore duly characterized in the following pages.

To the descriptions of these new forms are added those of several others obtained from various correspondents, and for some of which manuscript names have been sent out. Altogether, 4 new genera and 94 new species are described in this paper.

Family TIPULIDÆ.

ORIMARGA ARIZONENSIS, new species.

Body and head black, head and thorax rather densely gray pruinose, abdomen very thinly grayish pruinose, slightly polished, apex of female ovipositor reddish yellow, her pleura with a whitish vitta on the lower part; male claspers very broad, about one-fourth longer than broad, bluntly rounded at the apex; antennæ and mouth parts dark brown, halteres whitish, the base yellow, the knobs pale brown; coxæ dark yellow, remainder of legs pale yellow, apex of femora, both ends of tibiæ, and the tarsi toward the tips, brown; wings hyaline,

toward the base whitish, the extreme base dark yellow, venation as in Osten-Sacken's figure of *alpina*¹ with these exceptions: Apex of auxiliary vein at one-fourth of distance from base of second vein to marginal crossvein, small crossvein opposite or beyond the marginal crossvein; length 9 to 10 mm. A specimen of each sex collected June 25 and 26, 1901, by Mr. H. S. Barber.

Habitat.—Hot Springs, Yavapai County, Arizona.

Type.—Cat. No. 6154, U.S.N.M.

This European genus has not heretofore been reported from this country. The present form agrees well with the original description of this genus, except in the venation and the form of the claspers of the male.

Family CULICIDÆ.

CULEX BIMACULATUS, new species.

Bright yellow, the apices of the palpi and of the proboscis, also the antennæ except the bases, dark brown, a large black spot above insertion of each wing, apices of femora black, tarsi changing into brown toward the apices; bristly hairs and scales of head and body bright yellow, mesonotum highly polished; tarsal claws large, the front and middle ones toothed, the hind ones simple; wings hyaline, strongly tinged with yellow along the costa, lateral scales of the veins very small, interspersed with very elongate, narrow ones, petiole of first submarginal cell nearly as long as that cell, crossvein at apex of second basal cell nearly its own length from the one at apex of first basal cell; length, 5 mm. A female specimen collected June 16 by Mr. C. H. T. Townsend.

Habitat.—Brownsville, Texas.

Type.—Cat. No. 6259, U.S.N.M.

CULEX FLETCHERI, new species.

Head black, scales of occiput narrow, golden brown, on each side a patch of broad, appressed yellow ones, antennæ brown, the first joint and bases of the second and third yellow, palpi yellowish brown, proboscis black, the median portion brown; body black, metanotum brownish yellow, scales of thorax golden brown, the bristly hairs and those on the scutellum golden yellow, abdomen wholly covered with pale yellow scales; femora yellow, the apices and tibiæ blackish, the scales mixed white, yellow and black, not forming distinct bands; tarsi black, the bases yellowish brown, a band of white scales at bases of the three median joints on the front and middle tarsi, of the last four joints of the hind ones, claws very large, toothed; wings hyaline, veins yellow, scales sparse, small, those near base of wings chiefly yellowish,

¹Monographs Diptera N. Am., IV, pl. 1, fig. 9.

the others brown, the lateral ones on first four veins and upper branch of the fifth very narrow and elongate, petiole of first submarginal cell about half the length of that cell, crossvein at apex of second basal cell about its length from the one above it; halteres yellow, the knobs brown; length, 6 mm. Two females collected by Dr. James Fletcher, for whom this unique species is named.

Habitat.—Carnduff, Assiniboia, British America

Type.—Cat. No. 6255, U.S.N.M.

CULEX SQUAMIGER, new species.

Head and its members black, middle of proboscis brownish, scales of occiput mixed golden and pale yellow, many black ones along the eyes, palpi black scaled, those at base, before the middle and at apex white; body black, scales of middle of mesonotum golden brown, those along the sides and on the pleura pale yellow, bristly hairs of thorax mostly black, those of scutellum chiefly yellow; scales of abdomen black, a large patch at base of each segment and several scales scattered over the remainder pale yellow, scales of venter pale yellow; femora and tibiae brown, the scales mixed black and yellow, not forming distinct bands, posterior side of the femora yellow and yellow scaled; tarsi black, the scales mixed black and yellow, a band of whitish scales at bases of the last four joints, claws toothed; wings hyaline, veins yellow, densely covered with rather broad mixed brown and whitish scales and with many very narrow ones in the apical third of the wing, petiole of first submarginal cell about two-thirds as long as that cell, crossvein at apex of second basal cell less than its length from the one above it; halteres yellow, the knobs marked with brown; length, 5 mm. Four female specimens.

Habitat.—Palo Alto (V. L. Kellogg), and San Lorenzo (G. Eisen), California.

Type.—Cat. No. 6256, U.S.N.M.

Family CHIRONOMIDÆ.

CERATOPOGON GLABER, new species.

Black, knob of halteres white, abdomen yellowish brown, scutellum and legs yellow, apices of hind femora, of all tibiae and joints of tarsi, also an annulus near middle of front tibiae, black, bases of front femora and an indistinct annulus beyond the middle pale brownish; eyes narrowly separated on the front, mesonotum opaque, whitish pruinose and with a brown median vitta, abdomen spatulate, somewhat opaque, narrow hind margins of the segments yellowish; legs slender, not spinose, first joint of hind tarsi nearly twice as long as the second, the last one nearly twice as long as the fourth, the claws large and of an equal size; wings bare, whitish, third vein reaching to six-sevenths

length of wing, separated from the first and not connected with it by a crossvein, apex of first near one-third length of third, fourth forks at small crossvein; length, 2 mm. Two female specimens collected by Mrs. Annie T. Slosson.

Habitat.—Biscayne Bay, Florida.

Type.—Cat. No. 6155, U.S.N.M.

CERATOPOGON INERMIS, new species.

Black, the antennæ and legs dark brown, the palpi, scutellum, halteres, and tarsi yellow; eyes rather widely separated on the front, mesonotum opaque, on the sides gray pruinose; femora slender, without spines, first joint of hind tarsi nearly twice as long as the second, last joint over three times as long as the fourth, without spines, claws large and of an equal size, no empodia; wings hyaline, bare, third vein separated from the first, ending near five-sixths length of wing, fourth vein forking slightly beyond the small crossvein; length, nearly 1 mm. A female specimen collected June 27 by Mr. H. S. Barber.

Habitat.—Hot Springs, Yavapai County, Arizona.

Type.—Cat. No. 6156, U.S.N.M.

CERATOPOGON EXILIS, new species.

Black, the mouth parts, broad margin of scutellum, legs and halteres light yellow; plumosity of antennæ whitish, mesonotum polished, legs slender, without spines, first tarsal joint about twice as long as the second, the last two of nearly an equal length, claws small, of an equal size, empodia large; wings hyaline, bare, third vein contiguous to the first, ending near two-thirds length of wing, apex of first vein near middle of the third, fourth vein forking slightly beyond the small crossvein; length, 1 mm. A male specimen collected May 15 by Mr. H. S. Barber.

Habitat.—Washington, District of Columbia.

Type.—Cat. No. 6157, U.S.N.M.

CERATOPOGON STIGMALIS, new species.

Black, the knobs of halteres light yellow, legs brown, both ends of the tibiæ and whole of tarsi except apices of the joints yellow; eyes contiguous, mesonotum apparently subopaque (injured), legs slender, not spinose, first joint of hind tarsi about twice as long as the second, the fifth twice as long as the fourth, not spinose below, claws on all tarsi unequal in size, the longest almost as long as the last tarsal joint; wings hyaline, bare, third vein considerably thickened, ending near three-fifths length of wing, connected to the first by a crossvein, apex of first vein near three-fourths length of the third, costa emarginate at apex of the latter, lower branch of fourth vein obliterated except

toward its apex; length, 1 mm. A female specimen collected August 8 by Mr. H. S. Barber.

Habitat.—Las Vegas Hot Springs, New Mexico.

Type.—Cat. No. 6158, U.S.N.M.

CERATOPOGON PILOSUS, new species.

Head black, face yellowish brown, mouth parts and antennæ brown, first joint of the latter yellow, eyes contiguous, mesonotum brownish yellow, opaque, its hairs yellow, scutellum and middle of metanotum brown, pleura yellow, abdomen dark brown, bases of the segments and the venter yellow, legs yellow, not spinose, bearing many very long hairs, first tarsal joint slightly shorter than the second, the last two subequal in length; claws minute, of an equal size, empodia large; wings hyaline, wholly covered with brown hairs except those along basal half of costa and a patch at apex of third vein, which are light yellow, third vein contiguous to the first, ending at middle of length of wing, apex of first vein near two-thirds length of the third, fourth vein forking slightly beyond the small crossvein; halteres yellow; length, 1.5 mm. A female specimen collected May 3 by Mr. H. S. Barber.

Habitat.—Washington, District of Columbia.

Type.—Cat. No. 6159, U.S.N.M.

CERATOPOGON ANCORUS, new species.

Head yellow, upper half of occiput black, antennæ brown, the joints except the last one only slightly longer than broad; thorax and scutellum light yellow, mesonotum somewhat polished and marked with a large black spot, which is prolonged anteriorly in the middle and posteriorly at each hind angle, extending the entire length of the mesonotum; abdomen brown, the narrow sutures and the venter yellow; legs yellow, not spinose, first tarsal joint nearly twice as long as the second, last two joints subequal in length, claws minute and of an equal size; wings hyaline, almost wholly but sparsely covered with hairs, third vein contiguous to the first and to the costal vein, ending near middle of length of wing, fourth vein forking slightly beyond the small crossvein; halteres light yellow; length, nearly 1 mm. A female specimen collected by Mrs. A. T. Slosson.

Habitat.—Biscayne Bay, Florida.

Type.—Cat. No. 6160, U.S.N.M.

CERATOPOGON BELLUS, new species.

Head black, upper part of occiput silvery pruinose, antennæ yellow, the apices brown, plumosity yellow; body black, upper half of pleura and outer margins of scutellum except at the apex whitish; mesonotum opaque, gray pruinose, and marked with many brown dots arranged in longitudinal rows, the front end silvery pruinose and

marked with a few brown dots, abdomen partly light gray pruinose; legs slender, not setose, whitish, femora with a broad median and a narrow apical brown band, tibiae with a broad median brownish band and a narrow one at each end, first joint of hind tarsi over twice as long as the second, the third and fourth subequal in length and scarcely longer than broad, the fifth nearly twice as long as the fourth, claws rather large and of an equal size; wings bare except along the apical margin, hyaline, marked with eight black dots, situated as follows: just before small crossvein, below middle of fifth vein, before apex of each of its branches, beyond base and before apex of lower fork of fourth vein, before apex of upper fork of this vein, and at apex of third vein, the latter slightly beyond middle of length of wing, third vein contiguous to the first except toward its apex, tip of first vein near four-fifths of the third, fourth vein forks considerably beyond the small crossvein; halteres whitish, a black dot at base of the knob and another at its apex; length, 1 mm. A male specimen collected May 17 by Mr. H. S. Barber.

Habitat.—Washington, District of Columbia.

Type.—Cat. No. 6161, U.S.N.M.

CERATOPOGON SQUAMIPES, new species.

Black, knobs of halteres whitish, legs dark brown, the knees yellowish; eyes contiguous, mesonotum opaque, covered with appressed yellow hairs and with longer erect brown ones; legs rather slender, not spinose, bearing many long hairs; tibiae on the outer side bearing several lanceolate flattened bristles, first tarsal joint slightly shorter than the second, last two joints subequal in length; claws small, equal, empodia small; wings hyaline, wholly covered with hairs which are brown except a patch of yellowish ones at apex of third vein, this vein contiguous to the first, ending at middle of length of wing; apex of first vein near three-fourths length of the third, fourth vein forking considerably before the small crossvein; length, 1 mm. Three females collected August 14 and 19 by Mr. H. S. Barber.

Habitat.—Las Vegas Hot Springs, New Mexico.

Type.—Cat. No. 6162, U.S.N.M.

HETEROMYIA PRATTII, new species.

Head reddish brown, eyes rather widely separated on the front, antennae brown, the first joint and bases of several of the succeeding ones yellow, joints beyond the first noticeably longer than broad, thorax almost bare, black, the humeri and prothorax reddish brown, the sides, pleura, and metanotum sometimes reddish yellow, mesonotum somewhat polished, finely aciculate, not pruinose, prolonged anteriorly in a short spine, scutellum reddish brown, abdomen dark brown, hind margins of the first five segments yellow, somewhat polished, not

whitish pruinose except on the last two segments; legs reddish and brown, apices of middle and hind femora reddish yellow, tarsi light yellow, apices of joints and whole of fourth joint of hind ones brown, last joint of front ones white, the ends brown, front femora greatly thickened, spinose on under side, other femora and the tarsi not spinose, middle femora slender, hind ones considerably thickened toward the apices, first joint of front and middle tarsi over twice as long as the second, fourth joint less than half as long as the fifth, claws small, subequal in size, first joint of hind tarsi only slightly longer than the second, the fourth slightly over half as long as the fifth, the claws very unequal in size, the inner one about six times as long as the outer, almost as long as the last tarsal joint; wings bare, hyaline, a brown fascia extending from middle of first section of fourth vein almost to the hind margin of the wing, also a large brown spot reaching length of third vein and extending to apices of forks of fifth vein, leaving a hyaline spot below middle of third vein and in apex of fourth posterior cell; third vein connected with the first by a crossvein, reaching four-fifths length of wing, apex of first vein slightly before middle of the third, fourth vein forking slightly before the small crossvein; halteres whitish; length, 4 mm. Four females collected June 9 and 22 by Mr. F. C. Pratt, for whom the species is named.

Habitat.—St. Elmo, Virginia.

Type.—Cat. No. 6163, U.S.N.M.

TANYPUS STELLATUS, new species.

Yellowish brown, antennæ except the basal joint pale yellow, abdomen blackish, a whitish ring at three-fourths the length of each femur, tibiæ except each end, and tarsi except apices of the joints, light yellow, halteres yellow; mesonotum thinly gray pruinose; wings covered with brown hairs, whitish hyaline, marked over nearly the entire surface with many brown spots, several of which are confluent and inclose small whitish spots; costal cell except at its apex brown; first vein near its apex connected with the second by an oblique crossvein, fifth vein forks a short distance beyond the crossvein; length, 2 mm. A female specimen.

Habitat.—Texas.

Type.—Cat. No. 6164, U.S.N.M.

TANYPUS DISCOLOR, new species.

Yellowish brown, antennæ, scutellum, large portion of abdomen, legs except apices of femora and tibiæ, also the halteres, yellow; mesonotum grayish pruinose, most dense at the humeri and in front of scutellum; wings whitish hyaline, two crossbands and the apex largely brown; the first band is on a line with the humeral crossvein,

and along the costa is broadly connected with the second band which is located at the small crossvein; behind the fifth vein the second band is prolonged to meet the brown at apex of wing; the latter begins a short distance before the apices of the first and of the posterior branch of the fifth vein, and incloses a large hyaline spot in apex of the second and third posterior cells, also two yellowish costal spots; the brown along the costa comprises two spots of a darker color than the remainder of the brown at the apex of the wing, and between the first of these spots and the preceding brown band is a large yellow costal spot; wings densely covered with hairs, which are yellowish on the hyaline portions and brown on the dark parts; first vein a short distance before its tip connected with the second by an oblique crossvein, fifth vein forks slightly before the crossvein; length, 3 mm. A female specimen collected by Mrs. A. T. Slosson.

Habitat.—Franconia, New Hampshire.

Type.—Cat. No. 6165, U.S.N.M.

TANYPUS ALGENS, new species.

Yellow, three vittæ on the mesonotum, the metanotum, spots on the pleura, and the sternum, brownish black; mouth parts, apices of femora, and bases of tibiæ brownish; mesonotum grayish pruinose, the vittæ somewhat polished; wings covered with hairs, hyaline, crossed at the middle by a faint brownish band which extends from small crossvein halfway to the wingtip; first vein near its apex connected with the second by an oblique crossvein, fifth vein forks slightly before the crossvein; length, 3 mm. A female specimen collected July 9 by Prof. Trevor Kincaid.

Habitat.—Popof Island, Alaska.

Type.—Cat. No. 6166, U.S.N.M.

TANYPUS BARBERI, new species.

Male.—Yellowish white, apices and a broad band at middle of antennæ, three vittæ on mesonotum, the metanotum, spots on the pleura and the sternum, black; mouth parts, a band near bases of abdominal segments two to five, the whole of the following segments except their hind borders, also apices of femora, both ends of tibiæ, apices of first four joints of tarsi and whole of the last one, pale brownish; mesonotum opaque, gray pruinose; hairs of the antennæ pale yellowish; wings covered with hairs, hyaline, from the base to the small crossvein marked with three brown spots, one on the humeral crossvein and two behind the sixth vein; from small crossvein to wingtip are many, mostly isolated, brown spots; first vein near its apex connected with the second by an oblique crossvein, fifth vein forks slightly before the crossvein; length, 4 mm.

Female.—Like the male except that there is no black ring at middle

of antennæ, and the abdomen is dark brown, changing into yellow at the apex, the broad hind margins of the segments whitish; length, 3 mm. Four males and one female collected August 7 to 18 by Mr. H. S. Barber, for whom this fine species is named.

Habitat.—Las Vegas Hot Springs, New Mexico.

Type.—Cat. No. 6167, U.S.N.M.

TANYPUS VENUSTUS, new species.

Head black, mouth parts brown, antennæ pale yellow, middle of joints of basal half and whole of apical joint brown, the hairs brown and yellowish; thorax black, opaque, mottled with grayish pruinose spots and lines, scutellum yellowish, its narrow base, stripe in middle, and nearly whole of underside dark brown; abdomen whitish, an interrupted band on the hind end of the first five segments and nearly the whole of the following segments, brown; legs yellow, two bands near apex of each femur, one near base of each tibia, also apices of tibiæ and of joints of tarsi, brown; wings covered with hairs, hyaline, marked with about eleven brown spots located at extreme base of wing, on humeral crossvein, before middle of axillary cell, beyond middle of anal cell, on the central crossveins, near middle of first posterior cell, near apex of this cell, beyond middle of the second and of the third posterior cells, and at apices of the first and of the second veins; first vein near its apex connected with the second by an oblique crossvein, fifth vein forks slightly before the crossvein; length, 4 mm. A male specimen collected August 9 by Mr. H. S. Barber.

Habitat.—Las Vegas Hot Springs, New Mexico.

Type.—Cat. No. 6168, U.S.N.M.

TANYPUS PALLENS, new species.

Male.—Head brown, mouth parts and basal joint of antennæ concolorous, remainder of antennæ yellow, the hairs brown and whitish; thorax whitish, three vittæ on mesonotum, metanotum, spots on pleura and the sternum dark yellow; abdomen pale yellow, a band near base of segments two to five and nearly the whole of the following segments, pale brownish; legs and halteres whitish; wings hyaline, covered with hairs, first vein near its apex connected with the second by an oblique crossvein, fifth vein forks slightly before the crossvein; length 2.5 mm.

Female.—Abdomen wholly yellow, otherwise as in the male; length, slightly over 1 mm.

Two males and two females collected August 6 to 11 by Mr. H. S. Barber.

Habitat.—Las Vegas Hot Springs, New Mexico

Type.—Cat. No. 6169, U.S.N.M.

TANYPUS OCCIDENTALIS, new species.

Brown, the prothorax, a spot near each humerus, and the scutellum dark yellow, legs light yellow, halteres whitish; hairs of antennæ brown and yellow; wings hyaline, bare, first vein not connected with the second by a crossvein; fifth vein forks a short distance beyond the crossvein, the latter situated nearly its length before the small crossvein; length 4.5 mm. A male specimen.

Habitat.—Colorado.

Type.—Cat. No. 6170, U.S.N.M.

TANYPUS GUTTULARIS, new species.

Head and its members dark brown, joints two to four of antennæ, apices of the other short ones, and a space before the apex, light yellow, plumosity brown, changing into whitish at the apices; thorax black, opaque, gray pruinose, mesonotum marked with three indistinct dark vittæ, the middle one divided by a median black line prolonged to the scutellum, the latter light yellow; abdomen pale yellowish, first segment with two brown vittæ, the others with a black fascia before the middle of each, hairs of each segment consisting of an anterior whorl and a posterior transverse pair of clusters; legs light yellow, coxæ black, a brown band before apex of each femur and another beyond base of each tibia, apices of tibiæ and of tarsi brown, front tarsi ciliate with several rather long hairs; wings wholly covered with hairs, whitish hyaline, from base to small crossvein marked with four brown spots, one on humeral crossvein, two in anal cell and one before apex of first basal cell, passing over the crossvein at apex of second basal cell and reaching the wing-margin, where it is greatly extended and rather faint; a brown spot at base of third vein, apex of wing from slightly before tip of first vein grayish brown and containing several whitish hyaline drops; first vein near its tip connected with the second by an oblique crossvein; halteres whitish; length, 5 mm. Two males, collected May 10 by Mr. R. W. Doane.

Habitat.—Pullman, Washington.

Type.—Cat. No. 6171, U.S.N.M.

ORTHOCLADIUS CLEPSYDRUS, new species.

Black, the extreme bases of femora and of front tibiæ, also the other tibiæ except their apices, whitish; mesonotum polished, scutellum and dorsum of abdomen opaque, velvet-like; wings hyaline, each marked with an hourglass-shaped black spot extending from one-fourth length of wing almost to apex of upper branch of fifth vein, the constricted portion lying above the forking of the fifth vein, the basal expanded portion reaching from fourth vein nearly to hind margin of wing, the apical extending from third vein almost to hind margin of

wing; legs only pubescent, first joint of front tarsi about half as long as the tibiae, fourth tarsal joint rather slender and almost as long as the fifth; length, 1.5 mm. A female specimen collected August 7 by Mr. H. S. Barber.

Habitat.—Las Vegas Hot Springs, New Mexico.

Type.—Cat. No. 6172, U.S.N.M.

ORTHOCLADIUS PLATYPUS, new species.

Black, a large dull yellowish humeral spot, halteres, trochanters, and extreme bases of femora yellow; hairs of antennae dark gray, thorax opaque, grayish pruinose; tarsi only pubescent, the fourth joint dilated, emarginate at the apex, noticeably shorter than the fifth, first joint of front tarsi three-fourths as long as the tibiae; wings hyaline, small crossveins not darker than the adjacent veins, not clouded with brown, third vein beyond its middle slightly bowing toward the costa; length, 2.5 mm. A male specimen collected July 6 by Mr. H. S. Barber.

Habitat.—Flagstaff, Arizona.

Type.—Cat. No. 6173, U.S.N.M.

ORTHOCLADIUS POLITUS, new species.

Head yellow, antennae brown, its hairs yellowish brown; thorax yellow, three vittae on mesonotum, spot below each wing, the breast and metanotum black, mesonotum highly polished, scutellum brownish yellow, polished, its base opaque blackish; abdomen yellowish brown, becoming darker toward the apex; legs brown, trochanters and extreme bases of femora yellow, middle and hind tibiae and bases of their tarsi dull yellowish, legs only pubescent, fourth tarsal joint slender, as long as the fifth, first joint of front tarsi three-fourths as long as the tibiae; wings hyaline, small crossvein not darker than the adjacent veins, third vein almost straight; halteres yellow; length, 2.5 mm. A male specimen collected June 6 by Mr. H. S. Barber.

Habitat.—Washington, District of Columbia.

Type.—Cat. No. 6174, U.S.N.M.

CRICOTOPUS VARIPES, new species.

Head and its members black, hairs of antennae gray; thorax black, mesonotum highly polished, metanotum and scutellum opaque, velvet black; abdomen velvet black, the first two segments and hind margins of the following two polished yellow, genitalia yellow; femora black, the extreme bases and trochanters yellow, front tibiae and tarsi brown, the former with a broad median white band, other tibiae and tarsi yellow, their apices brownish, legs only pubescent, first joint of front tarsi two-thirds as long as the tibiae; wings whitish hyaline, small crossvein slightly darker than the adjacent veins, third vein almost

straight; halteres yellow; length, 2.5 mm. A male specimen collected May 6 by Mr. H. S. Barber.

Habitat.—Great Falls, Maryland.

Type.—Cat. No. 6175, U.S.N.M.

CHIRONOMUS PULCHRIPENNIS, new species.

Head and antennæ yellow, apical half of last joint of the latter and the mouth parts brown; thorax opaque, greenish yellow, mesonotum marked with a pair of lateral brown vittæ behind its middle, metanotum with a pair of brown spots which approach each other posteriorly; scutellum and abdomen green, the latter with the hind margins of the segments yellowish, bases of segments six to eight and nearly the whole of the following two brown; legs whitish, the knees black, this color extending nearly to the middle of the middle and hind femora, front tibiæ four-fifths as long as the first joint of their tarsi; wings whitish, the costal cell except its apex brown, a broad brown band crosses the wing, passing over the bases of the first and third posterior cells and prolonged along the hind margin nearly to the anal angle, apex of wings broadly brown from third vein to upper branch of the fifth; halteres white; length, 4 mm. A female specimen collected by Mrs. Annie T. Slosson.

Habitat.—Franconia, New Hampshire.

Type.—Cat. No. 6176, U.S.N.M.

CHIRONOMUS VARIPENNIS, new species.

Head and body dark brown, a large dull yellowish humeral spot, antennæ except the first joint yellow, the hairs gray; thorax opaque, largely gray pruinose, narrow hind margins of abdominal segments gray pruinose; femora brown, the ends narrowly and a band before the apex of each, yellow; front tibiæ very short, yellow, the bases brown, other tibiæ brown, an indistinct yellowish ring beyond the base; front tarsi wanting, the others yellow; wings whitish, marked with eleven brown spots as follows: Three in a row behind the fifth vein, one before middle and another in middle of apical margin of third posterior cell, one in base of first posterior cell, another in the cell below it, and a third midway between the latter and the base of this cell, one in middle and another in apex of first posterior cell, also a small one in apex of second posterior cell; halteres whitish; length, 3 mm. A male specimen collected August 14 by Mr. H. S. Barber.

Habitat.—Las Vegas Hot Springs, New Mexico.

Type.—Cat. No. 6177, U.S.N.M.

CHIRONOMUS ATRIMANUS, new species.

Head yellowish brown, antennæ yellow, the last joint and the mouth parts brown; thorax and scutellum black, highly polished; abdomen somewhat polished, black, the first segment yellow, hind margins of

three to six yellowish; legs yellow, front tibiae and their tarsi black, apices of femora, both ends of middle and hind tibiae, apices of joints of their tarsi and whole of the last two joints blackish, front tibiae four-fifths as long as the first joint of their tarsi; wings strongly tinged with yellow on the basal third, followed by a wide brown band extending from costa to fifth vein, remainder of wing hyaline; halteres yellow; length, 4.5 mm. A female specimen collected May 6, 1899, by Mr. C. F. Adams.

Habitat.—Kansas City, Missouri.

Type.—Cat. No. 6178, U.S.N.M.

CHIRONOMUS PALLIATUS, new species.

Head, mouth parts, and first joint of antennae dark brown, remainder of antennae livid, the hairs gray; thorax dark brown, mesonotum opaque, a broad, yellowish median vitta on the anterior half, and a widely separated pair of gray pruinose vittae on the posterior half; abdomen opaque, velvet black, its hairs yellow; legs yellowish white, front and middle femora except their apices, also bases of hind femora brownish, middle tibiae tinged with brown, front tarsi only pubescent, front tibiae three-fourths as long as their first tarsal joint, hind tibiae and their tarsi in the male densely clothed with rather long hairs; wings hyaline, slightly tinged with yellow, small crossvein not darker than the adjacent veins, third vein almost straight; halteres whitish; length, 2.5 to 4 mm. Three males and three females collected June 12 by Mr. H. S. Barber, except one of the females, which was collected by the writer in June.

Habitat.—Washington, District of Columbia.

Type.—Cat. No. 6179, U.S.N.M.

Family BIBIONIDÆ.

BIBIO TENUIPES, new species.

Black, the ridge behind each humerus yellow, spines of tibiae reddish brown; hairs of eyes black, those on under side of head, on body, and on upper side of front and middle femora chiefly light colored, those on remainder of legs chiefly black; spines of front tibiae very unequal in size, hind tibiae only slightly dilated, the outer side almost straight; wings hyaline, strongly tinged with yellow in the costal cell and with dark gray in the marginal and first basal cells, stigma and veins dark brown, bases of the fifth and sixth veins subhyaline, small crossvein scarcely one-fourth as long as the first section of the third vein; length, 5.5 mm. A male specimen collected June 5 by Mr. H. S. Barber.

Habitat.—Williams, Arizona.

Type.—Cat. No. 6180, U.S.N.M.

SCATOPSE VARICORNIS, new species.

Head and body black, mesonotum somewhat polished, antennæ about as long as the head and thorax, black, joints three to six bright yellow, apex of the last joint with a white reflection, joint three slightly longer than wide. the succeeding joints becoming successively shorter except the last one; legs dark brown, extreme ends of femora, apices of tibiæ, and whole of tarsi yellow, broad bases of tibiæ white; wings grayish hyaline, veins brown, apex of third vein near three-fourths length of wing, penultimate section of fourth vein about two-thirds as long as the upper fork of this vein, the forks gradually diverging from each other for a short distance, at which point the upper fork is strongly bowed upward, then extends nearly parallel with the lower one nearly to the wing-margin, where they diverge rather strongly from each other, fifth and sixth veins distinct, the latter strongly sinuous; length, 1.5 mm. A female specimen collected by Mr. Th. Pergande.

Habitat.—Washington, District of Columbia.

Type.—Cat. No. 6181, U.S.N.M.

Family SIMULIDÆ.

SIMULIUM FULVUM, new species.

Male.—Head and its members dark brown, occiput covered with rather long golden-yellow hairs, thorax reddish yellow, opaque, sides of scutellum and mesonotum in front of it bearing many rather long golden-yellow hairs; abdomen dark brown, opaque, on each side of the base is a large cluster of golden-yellow hairs more than half as long as the abdomen; legs dark yellow, apices of tibiæ and whole of tarsi pale brown; halteres dark yellow; wings hyaline, veins along costa brown, the others nearly hyaline.

Female.—Differs from the male as follows: Head, except upper part of occiput and the front, dark yellow, base of antennæ also yellow, hairs of occiput short and sparse; abdomen yellowish brown or dark yellow, usually changing into brown at the apex, the hairs at its base less than one-third as long as the abdomen; tarsi and tibiæ usually yellow.

Length, about 3 mm. One male and ten females.

Habitat.—Bear Paw Mountains, Montana (September 3, H. G. Hubbard); Custer County, Colorado (T. D. A. Cockerell); Mount Cheam (August 7, J. Fletcher), Lowe Inlet (June 3, T. Kincaid) and Laggan (H. F. Wickham), British Columbia; Sitka (June 16), Virgin Bay (June 26), and Kukak Bay (July 4, T. Kincaid), Alaska.

Type.—Cat. No. 6182, U.S.N.M.

I formerly mistook this species for Walker's *ochraceum*, but the male, besides being considerably smaller, has whitish pruinose vitta on the foretibia and bicolorous middle and hind tarsi.

SIMULIUM VIRGATUM, new species.

Male.—Head and body black, antennæ and mouth parts dark brown, thorax gray pruinose, mesonotum marked with a narrow median and laterally with a very broad velvet black vitta (viewed directly from above). mesonotum sparsely covered with short, appressed hairs; abdomen on first six segments opaque, velvet black, a large silvery white spot on each side of the second and sixth segments, venter near each side with an interrupted yellow vitta on segments three to seven, composed of appressed hairs, on each side of base of abdomen is a large cluster of yellow hairs, and a smaller cluster on each side of segments three to five; femora and front tibiæ yellow, their apices brown, middle tibiæ brown, a yellow ring beyond the base, hind tibiæ brown, the extreme base yellowish; tarsi black, broad base of first joint and extreme base of the second on the middle and hind tarsi light yellowish; wings hyaline, veins along the costa yellowish brown, the others nearly hyaline; halteres yellow.

Female.—Differs from the male as follows: Vittæ of mesonotum brownish, the median vitta dilated posteriorly, wider than either of the lateral ones; viewed from in front the mesonotum appears whitish pruinose and with two velvet black vittæ; abdomen on first five segments and sides of the sixth opaque, gray pruinose, and with a velvet black fascia at bases of three to six, broadly interrupted on six, the middle of which and the portion of the abdomen beyond it is very thinly pruinose and of a dark brown color.

Length, nearly 3 mm. Two males and two females collected August 4 to 14 by Mr. H. S. Barber.

Habitat.—Las Vegas Hot Springs, New Mexico.

Type.—Cat. No. 6183, U.S.N.M.

SIMULIUM GLAUCUM, new species.

Male.—Head and body black, face gray pruinose, thorax bluish gray pruinose, mesonotum marked with a narrow median and slightly wider lateral black vittæ, broad lateral margins when viewed from behind silvery white, a pair of large, subquadrate silvery spots on the front end separated by the median black vitta, which is here greatly dilated; abdomen velvet black, sides of segments two and five to nine silvery, middle of dorsum of four also silvery; venter almost wholly silvery; femora and tibiæ brown, bases of tibiæ yellow, anterior side of front ones largely silvery; tarsi black, broad base of first joint of the middle and hind ones whitish; wings hyaline, veins along the costa yellowish brown, the others nearly hyaline; halteres yellow; length, 2.5 mm. A single specimen collected April 8, 1898, by Mr. C. F. Adams.

Habitat.—Kansas City, Missouri.

Type.—Cat. No. 6184, U.S.N.M.

Proc. N. M. vol. xxv—02—7

Family STRATIOMYIDÆ.

AOCHLETUS OBSCURUS, new species.

Black, a yellow interrupted fascia on upper part of face, first two joints of antennæ and a short vitta above insertion of antennæ reddish brown, halteres yellow, base of first joint of each tarsus yellowish; upper three-fourths of front somewhat opaque, densely punctured and sparsely covered with short appressed whitish hairs, the lowest fourth nearly wholly occupied by a transverse pair of highly polished gibbous spots; face and cheeks, except the narrow gray pruinose orbits, somewhat polished and covered with appressed whitish hairs; antennæ much shorter than the head, very robust, the complex third joint larger than the remainder of the antennæ, composed of three annuli of which the first two are broader than long, the third about one-third longer than broad, tapering on its apical half, slightly longer than the apical style which is composed of three joints of nearly an equal length; thorax and scutellum nearly opaque, scabrous and sparsely covered with short appressed yellowish hairs; abdomen somewhat opaque, its hairs very short, black, those on sides of first segment and on hind angles of the second, third, and fourth rather long and yellowish; wings grayish hyaline, subcostal cell and apex of costal brown, stigma and veins brown: length, 9 to 10 mm. Two female specimens.

Habitat.—Los Angeles County, California (D. W. Coquillett); and Sulphur Spring Valley, Arizona (June 6, H. G. Hubbard).

Type.—Cat. No. 6185, U.S.N.M.

EUPARYPHUS TAHOENSIS, new species.

Head black, lateral margins of occiput, a pair of oblique spots on middle of front near the eyes and a pair of smaller ones on lower part of face, yellow; very narrow orbits of face and cheeks, and broad sides of occiput on the lower half, white pruinose; antennæ brown, the second joint largely yellowish brown; thorax black, a yellow vitta on either side of middle of mesonotum, a second near the lateral margin broadly interrupted behind the suture and greatly expanded at its posterior end, also a yellow vitta extends from humerus to base of wing, and one on upper part of the sternopleura; scutellum yellow, the basal two-fifths black, spines yellow, their apices brown; abdomen black, the margin and an interrupted fascia on the posterior part of the fourth segment, yellow; venter black, a large median yellowish spot on the second and third segments; femora black, the apices, tibiae and tarsi yellow, a brownish ring near middle of each hind tibia; wings hyaline, veins yellowish, those issuing from the discal cell nearly colorless, third vein simple; halteres yellow; length, 6 mm. A female specimen collected by Mr. H. G. Hubbard.

Habitat.—Lake Tahoe, California.

Type.—Cat. No. 6186, U.S.N.M.

EUPARYPHUS APICALIS, new species.

Head yellow, center of occiput, an ocellar dot, a transverse pair of oval spots below middle of front and a vitta on each side of face, black; a brownish spot near center of face: front with a paler yellow spot at the middle of the sides next the eyes, another above the antennæ and one back of the ocelli: head polished, the narrow orbits of the face and cheeks and broad sides of occiput on the lower half white pruinose: antennæ black, the first two joints yellow; thorax black, a yellow vitta each side of middle of mesonotum, a broader one extends from humerus to the hind angle and incloses a black spot behind the suture, another along upper edge of pleura and a short one on upper part of sternopleura; scutellum yellow, the narrow basal angles and tips of spines brown; abdomen at extreme base yellow, followed by black, which area is greatly narrowed on the posterior half of the second segment and still more so on the anterior half of the third, ending at the center of this segment, remainder of abdomen reddish yellow, the margin pale yellow, a black dot in middle of front edge of the fourth segment; venter yellow, the first segment black; legs yellow, joints three and four of the tarsi brownish; wings hyaline, stigma and veins yellowish brown, third vein forked; halteres yellow; length, 7 mm. A female specimen collected by Mr. A. Koebele.

Habitat.—Siskiyou County, California.

Type.—Cat. No. 6187, U.S.N.M.

EUPARYPHUS CRUCIGERUS, new species.

Head black, the broad orbital margins of occiput, vitta on each side of front, large spot on which the antennæ are inserted and large spot on each lower corner of face, connected along the eye with that on side of front, yellow; antennæ brown, the second joint and base of third yellowish; thorax black, a vitta on either side of middle of mesonotum, a broader one extending from each humerus to the hind angle, interrupted behind the suture, another on upper edge of pleura in front of wing, and one on upper part of sternopleura, also a dot above hind coxa, yellow; scutellum yellow, the extreme base black; abdomen black, the margin, a spot in middle of first segment and an interrupted fascia on the posterior part of the third and fourth, yellow; venter yellow, the broad lateral margins and nearly the whole of the first and fifth segments black; legs yellow, femora except the apices, and a median ring on the hind tibiæ black; wings hyaline, stigma and veins yellow, veins issuing from discal cell nearly colorless, third vein simple; halteres yellow; length, 7 mm. Five females.

Habitat.—Colorado.

Type.—Cat. No. 6188, U.S.N.M.

EUPARYPHUS ATRIVENTRIS, new species.

Differs from *E. crucigerus* as follows: Antennæ not inserted on a yellow spot, no yellow spots at lower corners of face, but the rather broad orbital margins yellow and covered with a whitish pruinosity, a yellow fascia on lower edge of front connected with the yellow vittæ on sides of front, no yellow spot in middle of first abdominal segment, the yellow fascia on the third segment three times interrupted, venter, except the margin, wholly black; length, 5 mm. A female specimen collected July 17, 1877.

Habitat.—Greeley, Colorado.

Type.—Cat. No. 6189, U.S.N.M.

EUPARYPHUS AMPLUS, new species.

Head black, the frontal triangle, broad sides of face and three vittæ near its middle, also the lower portion of occipital orbits, yellow; antennæ brown, toward the base yellowish, mouth parts yellow; thorax black, a widely separated pair of dorsal vittæ, a vitta extending from each humerus to slightly beyond the transverse suture, a large subtriangular spot on each posterior corner, a narrow vitta on upper edge of pleura, expanding in a large spot in front of wing, a spot above front coxa, a vitta on upper part of sternopleura and one or two small spots beyond its posterior end, yellow; scutellum yellow, the basal third black; abdomen black, a fascia on first segment, small, rounded spot in outer hind angles of the second, outer margin of remainder of abdomen and an oblique spot in each outer hind angle of the third and fourth segments extending at least one-third of the width of the abdomen, yellow; venter yellow, the first segment, lateral portions of the second and an interrupted fascia at bases of the third and fourth, black; coxæ black, their apices yellow, femora yellowish brown, their ends, the tibiæ and tarsi wholly yellow; wings hyaline, the costa and veins on costal half yellow, the others nearly hyaline, third vein forked; halteres yellow; length, 8.5 mm. A male specimen collected June 17, 1898, by Mr. E. J. Oslar.

Habitat.—Chimney Gulch, Colorado.

Type.—Cat. No. 6190, U.S.N.M.

Family BOMBYLIDÆ.**BOMBYLIUS RECURVUS**, new species.

Male.—Head and body black, front and face opaque, gray pruinose; face along the oral margin rather densely covered with pale yellow hairs mixed above with many brown ones, those on remainder of face sparse, brown, hairs of first two joints of antennæ and on the front also brown; third joint of antennæ only slightly dilated near the base;

proboscis about as long as the body; hairs of body pale yellow, a large cluster of brown ones at sides of third abdominal segment connected by a cross-band of short brown hairs which is prolonged along middle of dorsum, terminating in a small cluster at tip of abdomen; legs dark brown, under side of hind femora bearing several bristles; wings smoky brown at base, gradually changing to hyaline at the apex, second vein strongly recurved at its apex, its extreme apex nearer base of wing than the preceding part of the recurved portion, the marginal cell strongly widening from base to apex, penultimate section of lower branch of third vein from one-fourth to one-half as long as the last section, small crossvein slightly beyond middle of discal cell; halteres yellow.

Female.—Like the male except that the hairs of the face are mostly pale yellow, the short hairs of the front also of this color, and there are many brown hairs on the mesonotum.

Length, 6 to 8 mm. Two males and two females.

Habitat.—San Bernardino County (April, A. Koebele), and San Diego County (April, D. W. Coquillett), California.

Type.—Cat. No. 6191, U.S.N.M.

GERON SIGMA, new species.

Male.—Black, the halteres brown, the knobs partly or wholly pale yellow; third joint of antennæ less than twice as long as the first two, elongate-ellipsoidal, about three times as long as its greatest width, a distinct notch on upper edge a short distance before the tip; face and frontal triangle grayish pruinose; proboscis about twice as long as length of head, palpi almost reaching its middle; upper side of body opaque, velvety, a transverse pair of gray pruinose spots on front end of thorax; wings hyaline, stigma pale brown, branches of third vein as long as the preceding section, the upper branch, except at its extreme base, almost straight, in consequence of which the base of the second submarginal cell is rather pointed, hind crossvein strongly bent S-shaped, small crossvein near one-third length of discal cell.

Female.—Same as the male, with these exceptions: Front on the lower edge light gray pruinose, the remainder, like the mesonotum, dark grayish black, no gray pruinose spots on the front end of the latter, scutellum light gray pruinose, abdomen brownish, the narrow hind margins of the segments light gray pruinose, stigma of wings pale grayish.

Length, 2.5 mm. Three males and seven females.

Habitat.—Alabama (C. F. Baker), North Carolina, and Colorado (H. K. Morrison). Three of the Alabama specimens were received for naming from Mr. C. W. Johnson, of Philadelphia, and have been returned to him again.

Type.—Cat. No. 6192, U.S.N.M.

Family SCENOPINIDÆ.

PSEUDATRICHIA FLAVICEPS, new species.

Head dark yellow, the occiput except the sides and an emargination behind the ocelli, an ocellar spot, and spot in middle of lower half of front, black; antennæ and mouth parts black; thorax and scutellum polished, black, a large yellow spot at inner side of each humerus, an interrupted white line below each wing, hairs of mesonotum short, depressed, brassy yellow, arranged in stripes, those of pleura white; abdomen polished, bronze black, hind margins of segments two to six, white; legs black, the knees yellow, this color most extended on the front pair; wings hyaline, veins brown, apex of second vein close to tip of first, halteres pale brown, marked with a few white streaks and dots; length, 6 mm. Two females collected July 15 by Mr. H. S. Barber.

Habitat.—Williams, Arizona.

Type.—Cat. No. 6193, U.S.N.M.

PSEUDATRICHIA PILOSA, new species.

Black, polished, dorsum of abdomen bronze color, hind margins of segments two to five white, halteres white, a blackish spot on upper side of each knob; thorax and femora covered with rather long nearly erect white hairs mixed with many black ones on the mesonotum; wings hyaline, veins brown, second vein ending close to apex of the first; length, 4 mm. Two males collected by Mr. H. S. Barber.

Habitat.—Williams (July 7) and Hot Springs (June 28), Arizona.

Type.—Cat. No. 6194, U.S.N.M.

Family EMPIDÆ.

MYTHICOMYIA SCUTELLATA, new species.

Black, a spot above antennæ, the oral margin, corners of thorax and a vitta connecting the two on each side, a vitta on lower part of pleura, greater part of scutellum, venter, sides and hind margins of abdominal segments, halteres and knees light yellow, tarsi and apical portion of tibiæ brown; face opaque, gray pruinose, front, mesonotum and abdomen polished; wings hyaline, the veins brown; third joint of antennæ oval, less than twice as long as broad, slightly over twice as long as the style; hairs of body very short and sparse; length, 1.5 mm. Seven females collected June 6 by Mr. H. S. Barber.

Habitat.—Williams, Arizona.

Type.—Cat. No. 6195, U.S.N.M.

MYTHICOMYIA PICTIPES, new species.

Differs from *scutellata* as follows: Femora and tibiæ yellow, the former with a black vitta on upper side, the latter with a brown vitta

on the outer side; front and body opaque, mesonotum densely gray pruinose; third joint of antennæ narrow and elongate, about four times as long as broad; length, 2.5 mm. Two females collected May 29 by Mr. H. S. Barber.

Habitat.—Williams, Arizona.

Type.—Cat. No. 6196, U.S.N.M.

RHAMPHOMYIA ALBATA, new species.

Male.—Black, the knobs of halteres, also the hairs and bristles, white; eyes contiguous, third antennal joint elongate lanceolate, nearly five times as long as the style, proboscis slightly shorter than height of head; mesonotum and abdomen polished, not pruinose, abdomen compressed, hypopygium rather small, central filament free except its apex, not fractured nor flexuous, hairs of hypopygium rather short and sparse; scutellum bearing four bristles; legs slender, nearly bare, hind tibiæ bearing several short bristles on the outer side, first joint of hind tarsi considerably enlarged, over twice as thick as that of the front tarsi and with several short bristles on the upper side; wings hyaline, stigma grayish brown, sixth vein obliterated before reaching the wing margin.

Female.—With the exception of the sexual characters, like the male except that the apical portion of the wings beyond middle of discal cell is pale brown.

Length, 2.5 mm. Three males and five females collected May 29, June 2, 12, and 13, by Mr. H. S. Barber.

Habitat.—Williams, Arizona.

Type.—Cat. No. 6198, U.S.N.M.

Family CESTRIDÆ.

CUTEREBRA HISTRIO, new species.

Black, the abdomen steel-blue, apical portion of arista whitish; front somewhat opaque, very thinly grayish pruinose, the ocellar triangle and orbits polished, the latter marked with a gray pruinose spot near the middle and another at lower angle of front, a smaller spot near upper corner of facial depression, hairs of upper part of front chiefly black, on remainder largely white; face and cheeks densely gray pruinose, each side of face marked with four polished streaks, one of which is in lower part of facial depression, the other three extend inward from the eye, the upper one subtriangular and almost reaching the facial depression, the middle one almost reaching lower end of facial depression, then curving downward and extending parallel with the oral opening, reaching slightly farther backward than middle of cheek, the lowest streak joins the second near lower corner of facial depression, and a short distance from this junction it emits a broad but short branch toward the under side of the head; a velvet black streak on

either side of middle of facial depression, hairs of face and of cheeks white; mesonotum and scutellum opaque, bluish gray pruinose, the hairs black, a stripe of white ones above each wing, those of the pleura also white except a cluster of black ones near the upper edge; dorsum of first three abdominal segments polished, the sides, venter, and entire fourth segment densely gray pruinose but leaving several, mostly circular, polished spots; on bases of the second and third segments the gray pruinosity encroaches considerably on the dorsum, hairs of abdomen black; basal half of femora and tibiae largely, also extreme apices of tibiae, grayish pruinose, hairs black, a few white ones on upper side of middle femora and many on posterior side of front ones; wings and calypteres dark brown; length, 18 mm.; width of vertex, 3 mm.; width of head, 8 mm. A female specimen collected by Dr. A. Dugès.

Habitat.—Guanajuato, Mexico.

Type.—Cat. No. 6199, U.S.N.M.¹

Family TACHINIDÆ.

MEIGENIELLA, new genus.

Near *Cryptomeigenia* but the first vein beyond apex of auxiliary is distinctly bristly and the vibrissæ are nearer to the anterior edge of the oral margin. Head at vibrissæ much shorter than at base of antennæ, ocellar bristles directed obliquely forward, frontals in a single row each side, descending to base of third antennal joint, sides of face each about one-third as wide as the median depression, bearing a few short hairs, antennæ four-fifths as long as the face, the third joint nearly four times as long as the second, arista thickened on the basal fourth, the penultimate joint slightly longer than broad, facial ridges bristly on the lowest fourth, cheeks about one-fourth as wide as the eye height, eyes bare, proboscis short and robust, palpi clavate, well developed; first posterior cell open, ending at the wing tip, bend of fourth-vein rounded, without an appendage, hind crossvein much nearer the bend than to the small crossvein, last section of fifth vein less than one-third as long as the preceding section; hind tibiae not ciliate with bristles. Type, the following species:

MEIGENIELLA HINEI, new species.

Head yellow, occiput and sides of front black, bluish gray pruinose, frontal vitta dark brown, face whitish pruinose, antennæ and base of

¹ *Cuterebra lepidora* Coquillett. Suspecting that the types of this species, a male and a female, were injured by "greasing," they were immersed for twenty-four hours in chloroform, and this had the effect of restoring most of the normal markings. The head of the male, instead of being "destitute of light-colored pollen," as described, has spots of this kind almost as in the male of *C. americana*, while the pollen of the face and cheeks of the female is whitish instead of being brownish, as stated in the original description.

arista yellow, remainder of arista dark brown, vertex two-thirds as wide as either eye, two pairs of proclinate orbital bristles, palpi yellow, proboscis yellowish brown; thorax and scutellum black, bluish gray pruinose, the former with four black vittæ, three pairs of postsutural dorsocentral bristles and three sternopleurals, scutellum bearing three marginal pairs; abdomen yellow, a broad black dorsal vitta, nearly wholly yellowish gray pruinose, first segment with marginal, the two following with marginal and discal, the fourth nearly wholly but sparsely covered with bristles; coxæ, femora, and tibiæ yellow, tarsi brown; wings hyaline, third vein bearing three bristles near the base, costal spine minute, calypteres whitish; length 7 mm. A female specimen collected May 29, 1899, by Prof. J. S. Hine, for whom the species is named.

Habitat.—Hanging Rock, Ohio.

Type.—Cat. No. 6200, U.S.N.M.¹

ADMONTIA LIMATA, new species.

Black, including the palpi; vertex four-fifths as wide as either eye, uppermost pair of frontal bristles directed outward, two pairs of orbital bristles, frontals descending slightly below base of antennæ, sides of face bearing many macrochaetae and bristly hairs not arranged in rows, face and sides of front whitish pruinose, two or three small bristles above each vibrissa, antennæ almost as long as the face, the third joint four times as long as the second, its lower front angle slightly produced in the form of a blunt tooth, arista rather long pubescent, thickened on the basal third, cheeks one-third as broad as the eye height; body polished, the humeri and bases of the second and third abdominal segments whitish pruinose, three sternopleural bristles, scutellum bearing four marginal pairs, the last pair cruciate, abdomen with discal and marginal bristles on each segment; front tarsi not dilated, their pulvilli elongated; wings subhyaline, second basal and anal cells yellowish, costal and marginal cells smoky brown, third vein bearing two bristles near the base; calypteres yellowish; length 4.5 to 5 mm. Ten males, collected by Prof. J. M. Aldrich.

Habitat.—Moscow, Idaho.

Type.—Cat. No. 6202, U.S.N.M.

¹ *Alophora fenestrata* Bigot. The type was from Nevada, while the specimens referred to this species in my Revision of the Tachinidae, page 46, were from New Hampshire. A specimen from Moscow, Idaho, since received from Prof. J. M. Aldrich, agrees better with Bigot's original description, and probably belongs to the species he had before him; this specimen, however, belongs to the genus *Phoranthia*, and the wings have a much more vittate appearance than the New Hampshire specimens. The latter will therefore require a new name, for which *splendida* is proposed.

Type.—Cat. No. 6201, U.S.N.M.

PARADMONTIA, new genus.

Near *Admontia*, but the first vein bristly, first posterior cell closed far from the wing margin, etc. Head unusually short, nearly twice as high as long, slightly shorter at vibrissæ than at base of antennæ, ocellar bristles proclinate, frontals descending to apex of second antennal joint, sides of face each about one-sixth as wide as the unusually large facial depression, bearing two rows of macrochaetæ, vibrissæ widely separated, inserted on a level with anterior edge of oral margin, ridges bristly on lowest fourth, antennæ of male as long as face, the third joint about eight times as long as the second, in the female about two-thirds as long as the face, the third joint three times as long as the second, arista bare, in the male thickened on the basal four-fifths, the penultimate joint twice as long as wide, in the female thickened on the basal three-fifths, the penultimate joint one and one-half times as long as wide, eyes sparsely hairy, cheeks as wide as the eye height, proboscis short and robust, palpi clavate; first vein bristly on the basal half, the third bristly nearly to the small crossvein, third vein ending close to the extreme tip of wing, first posterior cell closed, its petiole three-fourths as long as the hind crossvein, the latter nearer to small crossvein than to bend of fourth vein, this bend somewhat angular and sometimes with a short stump of a vein. Type, the following species:

PARADMONTIA BREVIS, new species.

Black, the palpi yellow; vertex about twice as wide as either eye, three pairs of orbital bristles; mesonotum light gray pruinose and marked with four black vittæ, three pairs of postsutural dorsocentral bristles, two sternopleurals, scutellum bearing three marginal pairs, the third pair diverging; abdomen very short and broad, bases of last three segments gray pruinose, the bristles very short, a marginal pair on the second and third segments, the fourth almost wholly covered; hind tibiæ not ciliate, front pulvilli of male rather short, front tarsi of female dilated, the pulvilli very short; wings hyaline, calypteres whitish; length, 3 mm. A specimen of each sex collected by Mrs. Annie T. Slosson.

Habitat.—Biscayne Bay, Florida.

Type.—Cat. No. 6203, U.S.N.M.

NEÆRA LONGICORNIS, new species.

Black, the base of the third antennal joint and the palpi yellow; vertex twice as wide as either eye, two pairs of orbital bristles, frontals descending to the arista, facial ridges only slightly arcuate, bristly almost to the lowest frontals, facial depression excessively broad, sides of face very narrow, antennæ almost as long as face, the third joint six

times as long as the second, arista thickened on the basal four-fifths, the penultimate joint nearly half as long as the last one; thorax gray pruinose, three pairs of postsutural dorsocentral bristles, two sternopleurals, scutellum bearing four marginal pairs, the second and fourth very small; abdomen polished, narrow bases of last three segments whitish pruinose, second segment bearing a discal pair and marginal row of bristles, third with a discal and a marginal row, fourth with three rows; tarsi not dilated; wings hyaline, the base tinged with yellow, third vein bearing a bristle near the base, hind crossvein slightly nearer small crossvein than bend of fourth vein, calypteres whitish; length, 4 mm. A female specimen collected August 4, 1896, by Prof. C. A. Sheldon.

Habitat.—Oswego, New York.

Type.—Cat. No. 6204, U.S.N.M.

This European genus has not heretofore been reported from this country; in the table of genera given in my Revision of the Tachinidæ it would fall in with *Clausicella*, from which it will be distinguished by the bristly facial ridges.

CHÆTOPHLEPS POLITA, new species.

Black, including the palpi; vertex three-fourths as wide as either eye, no orbital bristles, frontals descending slightly below the arista, facial ridges ciliate nearly to lowest frontals, face in profile very convex, the sides below very narrow, about one-eighth as wide as the very large, subtriangular facial depression, antennæ almost as long as the face, the large third joint about six times as long as the second, arista thickened nearly to the middle, the penultimate joint slightly longer than broad, sides of front and face grayish pruinose, proboscis short and robust; mesonotum polished, three vittæ in front of the suture and the sides whitish pruinose, three pairs of postsutural dorsocentral bristles, two sternopleurals, scutellum bearing three long marginal pairs, the last pair diverging; abdomen polished, each segment bearing marginal, the last three also with short discal macrochætæ; front claws and pulvilli very short, hind tibiæ not ciliate; wings hyaline, first vein bearing three bristles on the apical third, the third bearing five near base, extending halfway to the small crossvein, hind crossvein midway between the small and the bend of the fourth, the latter arcuated, calypteres whitish; length, 3.5 mm. A male specimen collected by Prof. J. M. Aldrich.

Habitat.—Brookings, South Dakota.

Type.—Cat. No. 6205, U.S.N.M.

PELATACHINA LIMATA, new species.

Differs from my description of *pellucida*¹ as follows: Face yellowish gray pruinose, thorax marked with four black vittæ, abdomen pol-

¹ Revision of the Tachinidæ, p. 65.

ished, basal portions of last three segments thinly whitish pruinose, wings yellowish brown at base and along most of the veins, third vein bearing three bristles near the base, first posterior cell closed slightly before the wingmargin, costal spine very large; length, 8 mm. A female specimen collected by Prof. J. M. Aldrich.

Habitat.—Lewiston, Idaho.

Type.—Cat. No. 6206, U.S.N.M.

PSEUDAPINOPS, new genus.

Near *Apinops*, but the palpi wanting. Head at vibrissæ noticeably shorter than at base of antennæ, vibrissæ on a level with anterior edge of oral margin, facial ridges bristly nearly to the middle, cheeks almost one-third as broad as the eye height, sides of face bare, at narrowest part about one-tenth as wide as the median depression, antennæ of male nearly as long as the face, the third joint three times as long as the second, in the female two-thirds as long as face, the third joint scarcely longer than the second, arista bare, thickened on the basal half, the penultimate joint slightly longer than broad, eyes bare, frontal bristles descending below middle of second antennal joint, ocellar bristles directed obliquely forward and outward, proboscis short and robust, third vein with a few bristles near the base, other veins bare, first posterior cell open, ending just before the wingtip, bend of fourth vein arcuate, without an appendage, hind crossvein midway between the small and the bend. Type, the following species:

PSEUDAPINOPS NIGRA, new species.

Black, the antennæ and proboscis dark brown; vertex one and one-third times as wide as either eye, front not pruinose, face thinly whitish pruinose; one pair of orbital bristles, uppermost pair of frontal bristles directed outward; body not pruinose, three pairs of post-sutural dorsocentral bristles, two or three sternopleurals, scutellum bearing three long marginal pairs, no discal bristles; abdomen depressed, ellipsoidal, the hairs very short and depressed, the bristles also short, none on dorsum of first two segments, a few marginal ones on the third and several on posterior half of the fourth; legs robust, bristles few and short, claws and pulvilli short; wings nearly hyaline, costal and marginal cells tinged with pale brown, calypteres whitish; length, 5 mm. Fifteen males and two females collected by Prof. J. M. Aldrich.

Habitat.—Moscow, Idaho.

Type.—Cat. No. 6207, U.S.N.M.

HYALOMYODES DORSALIS, new species.

Male.—Black, the mouth parts dark brown; eyes almost contiguous, the frontal vitta obliterated for a short distance; mesonotum and scu-

tellum somewhat polished, not pruinose; abdomen gray pruinose, the first segment, a streak in posterior corners of the second and third, a median spot on front end of the last three segments and a dot at base of each bristle and hair, polished black; wings hyaline, calypteres whitish; length, 3 mm.

Female.—Vertex one and one-half times as wide as either eye; body gray pruinose, a small brownish median spot on the last three abdominal segments and a brownish streak in the hind angles of the second and third, indistinct brownish dots at bases of the hairs and bristles; length, 4 mm.

A specimen of each sex collected by Prof. J. M. Aldrich.

Habitat.—Moscow, Idaho.

Type.—Cat. No. 6208, U.S.N.M.¹

OESTROPHASIA CALVA, new species.

Yellow, the thorax brownish yellow, a spot above the neck, and in the male a transverse row of three spots behind middle of mesonotum, black; abdomen in the male with a median spot on each segment and a streak at the hind angles of the last three, in the female with hind margins of first three segments and one to three spots on the fourth, black; vertex in male as wide as distance between the two posterior ocelli, only one row of about five bristly hairs outside of the frontals; in the female the vertex is slightly over twice as wide as either eye, one row of bristly hairs outside of the frontals, and outside of this a second row of four orbital bristles; thorax slightly, the abdomen highly polished, hairs of abdomen short, depressed, first two segments with a marginal pair of bristles, third with a marginal row, the fourth nearly wholly covered on the apical half; wings whitish hyaline, the base to discal cell and in front of fourth vein to apex of first, yellowish brown, a brown crossband begins in apex of marginal cell and extends, greatly narrowed, over the hind crossvein where it turns basally along fifth vein, covering slightly over the apical half of the discal section; third vein bristly less than half way to small crossvein, first posterior cell closed at the wingmargin; length, 6 mm. One male and two female specimens.

Habitat.—Williams, Arizona (July 17, H. S. Barber); and Ottawa, Canada (W. H. Harrington).

Type.—Cat. No. 6209, U.S.N.M.

¹*Hydomyodes triangulifera* has not been described in the female sex; the vertex is as wide as either eye, the body opaque, gray pruinose, that on the first abdominal segment very thin and not concealing the ground color, the hind margin of the second segment and a dot at base of each bristle and hair polished black.

Leucostoma neomexicana was not known to me in nature when the Revision of the Tachinidae was published; on page 69 it was given as a synonym of *senilis*, but it is evidently distinct, and will readily be recognized by the white pruinose last two abdominal segments.

OESTROPHASIA SETOSA, new species.

Female.—Differs from *calva* as follows: Mesonotum with a transverse row of three black spots behind the middle, fourth abdominal segment black on more than the apical half, base of first segment black in the middle of upper edge, a broad black dorsal vitta, passing over the broad black hind margins of the first three segments; second segment bearing a scattered median cluster of eight bristles which extends nearly to the middle of the length of the segment, third with a cluster of eight in front of the marginal row, the fourth covered except at the base; third vein bristly almost to the small crossvein; length, 6 mm. A female specimen collected by H. K. Morrison.

Habitat.—Colorado.

Type.—Cat. No. 6210, U.S.N.M.

EXORISTOIDES HARRINGTONI, new species.

Black, the face and apex of proboscis yellowish, first two joints of antennæ and the palpi yellow; vertex one and one-half times as wide as either eye, one pair of orbital bristles and between each bristle and the frontals is an outwardly directed bristle, frontals descending to the arista, the latter thickened on the basal half, the penultimate joint shorter than broad, antennæ nearly as long as the face, the third joint five times as long as the second, eyes sparsely hairy, cheeks one-third as wide as the eye height; thorax grayish pruinose, the vittæ indistinct, three pairs of postsutural dorsocentral bristles, three sternopleurals, scutellum bearing four marginal pairs, the last pair cruciate; abdomen polished, the bases of the last three segments grayish pruinose, these segments bearing discal and marginal bristles; wings hyaline, a gray cloud at base of discal cell, a brown crossband extends from apex of first vein to slightly below the small crossvein; first vein wholly bristly, the third from its base to beyond apex of discal cell, first posterior cell closed and short petiolate, ending slightly before apex of wing, bend of fourth vein rectangular and with a short stump, hind crossvein nearer the small than to bend of fourth; calypteres whitish; length, 4 mm. A female specimen collected by Mr. W. Hague Harrington, for whom this fine species is named.

Habitat.—Ottawa, Canada.

Type.—Cat. No. 6211, U.S.N.M.

EXORISTA TRISETOSA, new species.

Black, including the palpi; vertex of male one and one-half, of female twice, width of either eye, two pairs of orbital bristles in female, frontals descending to the arista, antennæ slightly shorter than the face, the third joint two and one-half times as long as the second, arista thickened to the middle, facial ridges bristly on the lower two-fifths, cheeks one-fifth as wide as the eye height; proboscis rather

er, the labella small; thorax gray pruinose, marked with four black vittæ, three pairs of postsutural dorsocentral bristles, three pairs of sternopleurals, scutellum bearing four marginal pairs, the last pair directed backward; abdomen polished, bases of last three segments gray pruinose, first segment with marginal, the following two also with discal, the last one nearly covered with rather long bristles; middle tibiæ each bearing two or three long bristles on the outer-anterior side, hind tibiæ somewhat unevenly ciliate on the outer-anterior side, wings hyaline, third vein with three or four bristles near the base, calypteres white; length, 5 to 7 mm. Seven males and one female collected August 26, 1895, by Prof. J. M. Aldrich.

Habitat.—Moscow and Lewiston, Idaho.

Type.—Cat. No. 6212, U.S.N.M.

NEMORÆA SETIGERA, new species.

Black, the face, palpi, and fourth abdominal segment yellow, apex of proboscis dark brown; vertex slightly narrower than either eye, two pairs of orbital bristles, frontals descending to the arista, sides of front on lower part, face and cheeks golden yellow pruinose, a few bristles above each vibrissa, cheeks one-fifth as broad as the eye height, antennæ slightly shorter than the face, the third joint very broad, twice as long as the second, arista thickened to the middle, the penultimate joint slightly longer than broad, proboscis rather slender, labella narrow; body slender, thorax gray pruinose, marked with four black vittæ, three pairs of postsutural dorsocentral bristles, three pairs of sternopleurals, scutellum bearing four marginal pairs, the last one the smallest, cruciate; abdomen thinly gray pruinose on the first three segments, the second and third bearing basal, discal, and marginal bristles; front tarsi distinctly dilated, middle tibiæ bearing four bristles on the outer-anterior side, hind tibiæ not ciliate; wings hyaline, crossveins not clouded, third vein bearing four bristles near the base, first posterior cell closed in the margin, hind crossvein near the bend of the fourth, the latter rectangular and with a long stump, calypteres white; length, 10 mm. A female specimen collected August 15, 1897, by Prof. J. S. Hine.

Habitat.—Medina, Ohio.

Type.—Cat. No. 6213, U.S.N.M.

PHOROCERA STERNALIS, new species.

Black, the scutellum except at base, and a spot on sides of second abdominal segment of male, yellow; vertex of male nearly as wide as, in the female one and one-fourth times as wide as, either eye, two pairs of orbitals in the female, frontals descending almost to the arista, the latter thickened on the basal half, the penultimate joint slightly longer than broad, antennæ almost as long as the face, the third joint in the male very broad, four times as long as the second, in the female three

times as long as the second, sides of front and face bluish gray; proboscis short and robust; thorax grayish pruinose and marked with four black vittae; four pairs of postsutural dorsocentral bristles, four sternopleurals; scutellum bearing four marginal pairs, the last pair directed backward; abdomen polished, the last three segments except the narrow hind margins thinly grayish pruinose, all with marginal, the second and third also with discal, the fourth wholly covered with bristles; hind tibiae somewhat unevenly ciliate with bristles, middle tibiae bearing three or four large ones on the outer-anterior side, front pulvilli male as long as the last tarsal joint; wings hyaline, third vein bearing two bristles near the base, first posterior cell broadly open, calyptere white; length, 7 to 8 mm. One male and two females.

Habitat.—Franconia, New Hampshire (Mrs. A. T. Slosson); Eddington, Maine (Dr. G. de N. Hough); and Moscow, Idaho (J. M. Aldrich).

Type.—Cat. No. 6214, U.S.N.M.¹

FRONTINA SETIPES, new species.

Black, the palpi yellow; vertex one and one-fourth times as wide as either eye. frontal bristles descending slightly below the arista, the two upper pairs stout, reclinate, sides of front yellowish gray; the face whitish gray pruinose, facial ridges bristly on the lower two-thirds, antennae somewhat shorter than the face, the third joint three and one-half times as long as the second, arista thickened on the basal third, the penultimate joint slightly longer than broad, cheeks one-fourth as broad as the eye height, proboscis short and very robust; thorax bluish gray pruinose, marked with four black vittae, three pairs of postsutural dorsocentral bristles, three sternopleurals, scutellum bearing four marginal pairs, the last one the smallest, cruciate, almost vertical; abdomen on last three segments densely gray pruinose and with darker reflecting spots, first segment and narrow hind margins of the others polished black, all with marginal, the fourth also with discal bristles; hind tibiae somewhat unevenly ciliate, middle tibiae bearing two long and three short bristles on the outer-anterior side, front pulvilli slightly longer than the last tarsal joint; wings hyaline, third vein bearing four bristles near the base, calypteres white; length, 8 mm. A male specimen collected by Prof. J. M. Aldrich.

Habitat.—Brookings, South Dakota.

Type.—Cat. No. 6216, U.S.N.M.

¹ *Phorocera parva* Bigot. The type has been studied by Dr. F. Brauer, who says that it belongs to the genus *Paraduria*. The form referred to this species in my *Revision of the Tachinidae*, page 103, will therefore require a new name, for which *arecta* is proposed; in this species the apical pair of scutellar bristles is directed almost vertically.

Type.—Cat. No. 6215, U.S.N.M.

STURMIA LIMATA, new species.

Black, the palpi yellow; vertex slightly wider than either eye, the two upper pairs of frontal bristles reclinate, much longer than the others, sides of front grayish, the face whitish pruinose, frontals descending nearly to apex of second antennal joint, vibrissæ slightly above front edge of oral margin, ridges bristly nearly to middle, antennæ five-sixths as long as the face, the third joint two and one-half times as long as the second, narrow, arista thickened to middle, the penultimate joint shorter than broad, cheeks one-fifth as broad as the eye height, proboscis rather slender, labella small; thorax gray pruinose, marked with four black vittæ, four pairs of postsutural dorsocentral bristles, four sternopleurals, scutellum bearing four marginal pairs, the last one cruciate and nearly vertical; abdomen polished, the second segment thinly gray pruinose, the following ones except their bases velvety, first three segments with marginal bristles, the fourth with a marginal and submarginal row; hind tibiæ rather evenly ciliate, middle tibiæ bearing two bristles on the outer-anterior side, front pulvilli slightly shorter than the last tarsal joint; wings hyaline, third vein bearing four bristles near the base, fourth vein beyond the bend nearly straight, calypteres white; length, 7 mm. Two males.

Habitat.—Opelousas, Louisiana (April, 1897, G. R. Pilate), and Ohio.

Type.—Cat. No. 6217, U. S. N. M.

STURMIA AUSTRINA, new species.

Black, the palpi yellow; vertex of male one-half, of female nearly as wide as either eye, frontals descending to the arista, two pairs of orbitals in female, sides of front grayish, face whitish pruinose, vibrissæ on a level with front edge of oral margin, ridges bristly nearly to middle, cheeks one-tenth the eye height, antennæ almost as long as the face, the third joint of male five, of female four times as long as the second, arista slightly thickened on the basal third, the penultimate joint scarcely longer than broad, proboscis short and robust; thorax gray pruinose, four black vittæ, four pairs of postsutural dorsocentral bristles, three sternopleurals, scutellum bearing four marginal pairs, the last one very short and nearly horizontal; abdomen gray pruinose on broad bases of the last three segments, the second and third with marginal, the fourth almost wholly covered with bristles; hind tibiæ ciliate, middle tibiæ bearing one bristle on the outer-anterior side, front pulvilli of male slightly longer than the last tarsal joint; wings hyaline, third vein bearing a single bristle near the base, fourth vein beyond the curve nearly straight, calypteres white; length, 4.5 to 5.5 mm. A specimen of each sex bred from a *Pyralid* by Dr. H. G. Dyar.

Habitat.—Nassau, Bahamas Islands.

Type.—Cat. No. 6218, U. S. N. M.

Proc. N. M. vol. xxv—02—8

STURMIA DISCALIS, new species.

Black, the palpi yellow; vertex nearly twice as wide as either eye, two pairs of orbital bristles, frontals descending to apex of second antennal joint, antennæ nearly as long as the face, the third joint about five times as long as the second, arista thickened on the basal fourth, the penultimate joint shorter than broad, cheeks one-fourth as wide as the eye height, vibrissæ on a level with front edge of oral margin, facial ridges bristly on the lowest fourth, proboscis rather slender; thorax gray pruinose, marked with four black vittæ, three pairs of post-sutural dorsocentral bristles, three sternopleurals, scutellum bearing three pairs of large marginal bristles, the last pair diverging, directed backward; abdomen yellowish gray pruinose, the broad apices of the last three segments polished, each segment bearing marginal, the last three also with discal bristles, venter depressed, destitute of short, backwardly curving spines in the middle; hind tibiæ unevenly ciliate, middle tibiæ bearing a single bristle near the middle of the outer-anterior side; wings hyaline, third vein bearing two bristles near the base, calypteres white; length, 8 mm. A female specimen.

Habitat.—Wisconsin.

Type.—Cat. No. 6219, U.S.N.M.

MASICERA POLITA, new species.

Differs from *Sturmia discalis* as follows: Palpi black, vertex one-third as wide as either eye, no orbitals, frontals descending nearly to middle of third antennal joint, the latter three times as long as the second, cheeks one-sixth the eye height, body polished, the mesonotum and narrow bases of the last three abdominal segments thinly whitish pruinose, middle tibiæ bearing three bristles near the middle of the outer-anterior side, hind tibiæ not ciliate, third vein of wings bearing a single bristle near the base, front pulvilli elongate; length, 5 mm. A male specimen collected August 8 by Mr. C. H. T. Townsend; received from Prof. T. D. A. Cockerell.

Habitat.—White Mountains, New Mexico (altitude about 8,000 feet).

Type.—Cat. No. 6220, U.S.N.M.

EUTHERA BICOLOR, new species.

Head yellow, occiput with a broad black streak extending from the neck to each eye and bordered below by a whitish pruinose stripe which extends downward along the orbit, sides of front and face whitish pruinose, vertex four-fifths as wide as either eye, two pairs of orbitals, frontals short and sparse, descending to base of antennæ, cheeks one-sixth as wide as the eye height, antennæ as long as the face, the first two joints yellow, the third black, slightly over twice as

long as the second, arista yellow at base, thickened on the basal fourth, mouth parts yellow; thorax and scutellum black, thinly whitish pruinose, the mesonotum with three broad black vittæ, two sternopleural bristles, scutellum bearing three marginal pairs, the last one very small and diverging; abdomen polished, reddish yellow, a dorsal subtriangular brownish spot extends over the first two segments, very short marginal bristles on the last three segments; coxæ and femora reddish yellow, tibiæ dark brown, tarsi black; wings from base to apex of anal cell, and from slightly beyond humeral crossvein obliquely almost to middle of discal section of fifth vein, yellow, behind fifth vein and along the apex gray, remainder brown except an oblique whitish hyaline fascia almost crossing the wing beyond the hind crossvein; first posterior cell closed, its petiole less than half as long as the hind crossvein; calypteres yellow; length, 4.5 mm. A female specimen.

Habitat.—Texas.

Type.—Cat. No. 6221, U.S.N.M.¹

MUSCOPTERYX TIBIALIS, new species.

Black, the palpi, tibiæ, and second antennal joint of female yellow, cheeks and lower part of face reddish brown; vertex of male one-third, in the female as wide as either eye, sides of face bearing three or four irregular rows of rather long bristly hairs of nearly an equal length, thorax subopaque, gray pruinose and with four black vittæ, scutellum bearing three marginal pairs of bristles, the last one cruciate, only slightly shorter than the first; abdomen somewhat polished, light grayish pruinose and with reflecting darker spots; wings hyaline, tinged with brownish toward the base, third vein bearing two bristles near the base, bend of fourth vein angular and with a short stump of a vein, the vein strongly bent inward beyond the bend; calypteres whitish; length, 7 to 9 mm. A specimen of each sex collected April 23, 1898, by Prof. J. M. Aldrich.

Habitat.—Moscow and Julietta, Idaho.

Type.—Cat. No. 6223, U.S.N.M.

¹ *Chatolyga nigrifacies* Bigot. Dr. F. Brauer has examined the type of this species and reports that it belongs to the genus *Pelmatomyia* or *Paraxorista*. The species referred to it in my Revision of the Tachinidæ, page 125, will therefore require a new name, for which *antennalis* is proposed; the specimen is a female, black, the sides of the second abdominal segment, hind angles of the first and front angles of the third yellow, antennæ as long as the face, the third joint over three times as long as the second, front tarsi noticeably dilated, third vein bearing a single bristle near the base.

Type.—Cat. No. 6222, U.S.N.M.

MUSCOPTERYX OBSCURA, new species.

Differs from the male of *tibialis* as follows: Tibiæ, cheeks, and face black; vertex one-fourth as wide as either eye, bristly hairs on sides of face very short, mesonotum somewhat polished, not pruinose; abdomen thinly brownish pruinose, without reflecting darker spots; third vein bearing about four bristles near the base, bend of fourth rounded, without a stump, the vein almost straight beyond the bend; calypteres yellow; length, 7 mm. Two males collected July 30 and August 24, 1897, by Prof. Trevor Kincaid.

Habitat.—St. Paul Island, Alaska.

Type.—Cat. No. 6224, U.S.N.M.

PHORICHÆTA CINEROSA, new species.

Black, the third antennal joint at base yellow, palpi at apex yellow, changing to brown at the base; sides of front, face and cheeks opaque, grayish pruinose, antennæ three-fourths as long as the face, the third joint blunt pointed at the apex, three times as long as the second; thorax and scutellum somewhat polished, rather thinly gray pruinose; abdomen highly polished, the second and third segments bearing discal and marginal bristles; wings hyaline, third vein bristly nearly to apex of discal cell; length, 4 mm. One specimen collected July 5 by Mr. H. S. Barber.

Habitat.—Flagstaff, Arizona.

Type.—Cat. No. 6225, U.S.N.M.

BRACHYCOMA PUBICORNIS, new species.

Black, including the palpi; vertex nearly half as wide as either eye, frontal bristles in a single row each side, descending slightly below base of second antennal joint, sides of face bearing a row of rather long bristles on the lower half, on the upper half with one or two irregular rows of very short bristly hairs, antennæ three-fourths as long as the face, the third joint nearly twice as long as the second, arista brown, the middle yellowish, distinctly pubescent, the longest slightly longer than greatest diameter of arista, the latter thickened almost to the middle, vibrissæ slightly above front edge of oral margin, ridges bristly on lowest third, proboscis rather short and robust; thorax grayish pruinose and with three black vittæ, scutellum bearing three pairs of marginal bristles, the last one cruciate and but slightly shorter than the others; abdomen grayish pruinose and with darker reflecting spots, first two segments without dorsal bristles, the last two with marginal ones, second segment of hypopygium polished; hind tibiæ not ciliate; wings hyaline, brownish at base and along most of the veins, third vein bristly nearly halfway to small crossvein, bend of fourth rectangular and with a short stump, costal spine minute;

calypteres whitish; length, 11 mm. A male specimen collected by Prof. J. M. Aldrich.

Habitat.—Harrison, Idaho.

Type.—Cat. No. 6226, U.S.N.M.

BRACHYCOMA SETOSA, new species.

Differs from *pubicornis* as follows: Vertex two-thirds as wide as either eye, sides of face bearing two irregular rows of rather short bristles of nearly an equal length, antennae four-fifths as long as the face, arista bare, proboscis somewhat elongate, rigid, slender, labella very narrow, abdomen with a pair of marginal bristles on the second segment, second segment of hypopygium somewhat opaque, thinly pruinose, wings not brownish along the veins, costal spine nearly as long as the small crossvein; length, 8.5 mm. A male specimen collected July 24 by Prof. T. D. A. Cockerell.

Habitat.—Beulah, New Mexico.

Type.—Cat. No. 6227, U.S.N.M.

GÆDIOPSIS COCKERELLII, new species.

Black, the face, cheeks, and apices of palpi yellow, scutellum reddish brown; vertex one and one-fourth times as wide as either eye, sides of front thinly grayish pruinose, frontal bristles descending to the arista, an irregular row of bristles outside of them, sides of face on outer half covered with short bristly hairs, the inner half with a row of bristles, sides of face and cheeks densely pale yellowish pruinose, vibrissae at a short distance above the oral margin, ridges bristly on the lower three-fourths, antennae four-fifths as long as the face, the third joint two and one-half times as long as the second, arista thickened on the basal two-thirds, cheeks nearly half as wide as the eye height; thorax thinly gray pruinose and marked with four black vittae; abdomen short and broad, somewhat opaque, not pruinose except on under side of the fourth segment, dorsum densely covered with rather long, and nearly erect bristly hairs, the first three segments bearing marginal bristles; hind tibiae evenly ciliate on the outer-anterior side and with a much longer bristle in the middle; wings hyaline, the base brown, small crossvein clouded with brown, third vein bearing two bristles near the base, calypteres brown; length, 11 mm. A male specimen collected August 20 by Mr. C. H. T. Townsend, and received from Prof. T. D. A. Cockerell, for whom this fine species is named.

Habitat.—White Mountains, New Mexico (altitude about 8,200 feet).

Type.—Cat. No. 6228, U.S.N.M.

GÆDIOPSIS FACIALIS, new species.

Black, the second antennal joint, palpi, apex of scutellum, a spot on sides of second and the fourth abdominal segment yellow; vertex as

wide as either eye, a row of stout bristles outside of the frontals, ocellars present, large, sides of front yellowish gray, the face and cheeks whitish pruinose, sides of face bearing several short bristly hairs on the lower portion, antennæ nearly as long as the face, the third joint almost six times as long as the second; thorax gray pruinose, marked with four black vittæ, apical pair of scutellar bristles nearly horizontal, abdomen grayish pruinose and with darker reflecting spots, second and third segments bearing marginal bristles; hind tibiæ on the outer-anterior side evenly ciliate with short bristles and with a much longer one at the middle; wings hyaline, third vein bearing two bristles near the base, calypteres white; length, 9 mm. A male specimen collected by Mr. H. K. Morrison.

Habitat.—Georgia.

Type.—Cat. No. 6230, U.S.N.M.

GÆDIOPSIS OCELLARIS, new species.

Differs from *facialis* as follows: Antennæ and abdomen black, lower portion of sides of front, the face and fourth abdominal segment densely golden yellow pruinose; sides of face bearing two irregular rows of bristles, ocellar bristles wanting, a pair of marginal bristles on the first abdominal segment; length, 9 mm. A male specimen collected June 18, 1891, by Prof. James S. Hine.

Habitat.—Ohio.

Type.—Cat. No. 6229, U.S.N.M.

PARAPHYTO SARCOPHAGINA, new species.

Black, the antennæ, face, and cheeks reddish brown, palpi yellow; vertex one-fourth as wide as either eye, sides of face bearing a few short bristly hairs on the upper edge, antennæ half as long as the face, the third joint scarcely longer than the second, longest hairs of arista slightly longer than greatest diameter of arista, vibrissæ a short distance above oral margin, cheeks nearly half as wide as the eye height, head at vibrissæ slightly shorter than at base of antennæ, proboscis slender, labella unusually slender; thorax gray pruinose and marked with three black vittæ, three pairs of postsutural dorso-central bristles, two sternopleurals, scutellum bearing three marginal pairs, the third pair cruciate; abdomen grayish pruinose and with darker reflecting spots, hairs depressed, second and third segments with marginal bristles, the fourth with a submarginal row of large bristles and a marginal row of small ones; claws and pulvilli very long; wings hyaline, tinged with yellowish toward the base, third vein bearing three bristles near the base, calypteres whitish; length, 10 mm. A male specimen collected by Mr. Charles Robertson.

Habitat.—Carlinville, Illinois.

Type.—Cat. No. 6231, U.S.N.M.

MERIANIA CHALYBÆA, new species.

Head black, facial depression yellowish, bordered each side by reddish brown which, below the middle, is prolonged to the lower end of the eye, frontal vitta of male almost obliterated for a short distance, vertex of female one and one-fourth times as wide as either eye, female with the ocellar bristles present and three pairs of orbitals, wanting in the male, frontals descending nearly to middle of second antennal joint, sides of face covered on the triangular upper outer half with rather long, black bristly hairs, vibrissæ far above the oral margin, ridges bristly on the lowest fourth; antennæ orange yellow, scarcely reaching below middle of face, the third joint only slightly longer than the second, arista brown, thickened on the basal third, the penultimate joint shorter than broad; proboscis black, palpi yellow; thorax blackish steel blue, thinly whitish pruinose, and marked with four black vittæ, four pairs of postsutural dorsocentral bristles, three sternoplurals; scutellum reddish yellow, bearing five marginal pairs of bristles, the last pair the shortest, cruciate; abdomen steel blue, polished, very thinly whitish pruinose, last three segments with discal and marginal bristles; legs black, hind tibiæ not ciliate, front pulvilli of male longer than last tarsal joint, last four joints of front tarsi of female greatly dilated; wings hyaline, third vein bearing three small bristles near the base, calypteres whitish, bordered with brown; length, 8 to 11 mm. Two males and five females, collected by Prof. J. M. Aldrich.

Habitat.—Moscow, Vollmer (May 30), Julietta, (Grangeville, and Craig Mountains, Idaho.

Type.—Cat. No. 6232, U.S.N.M.

This European genus has not heretofore been recorded from this country. In the table of genera given in my Revision of the Tachinidæ it would belong to couplet 43, and will be recognized by the absence of ocellar bristles in the male and the greatly dilated front tarsi of the female; the first posterior cell ends far before the wingtip.

AMOBIA AURATA, new species.

Black, including the palpi; sides of front, of face, and the cheeks golden yellow pruinose; sides of face bearing two rows of rather short bristly hairs; thorax gray pruinose, marked with three black vittæ, a black streak on pleura in front of wing; abdomen on first three segments bluish gray pruinose, the hind margin of each and three triangular spots extending from it across the segment, black; fourth segment and remainder of abdomen posterior to it golden yellow pruinose, the former crossed longitudinally with three brownish spots; wings hyaline, third vein bearing two bristles near the base, calypteres white; length, 7 mm. Three female specimens.

Habitat.—White Mountains, New Hampshire (H. K. Morrison); Milwaukee, Wisconsin (Dr. S. Graenicher); and Harrison, Idaho (J. M. Aldrich).

Type.—Cat. No. 6233, U.S.N.M.¹

GYMNOMMA QUADRISETOSA, new species.

Head yellow, upper part of occiput and sides of front black, yellowish gray pruinose, hairs of face and cheeks yellowish white, antennæ yellow, the third joint yellowish brown, slightly longer than the second, strongly convex on the upper side, proboscis black; thorax black, densely yellowish gray pruinose and with four black vittæ, four pairs of postsutural dorsocentral bristles, three sternopleurals, scutellum yellowish brown, abdomen black, polished, second segment with a marginal pair of bristles, the third with a marginal row, the fourth covered except on the basal third, on either side of the first and second segments are two or three stout bristles; legs black; wings grayish, the base tinged with yellow, base of third vein bearing six bristles, calypteres yellowish smoky brown; length, 12 mm. Five females collected July 15 by Mr. C. H. T. Townsend.

Habitat.—Sierra Madre, Mexico (altitude about 7,300 feet).

Type.—Cat. No. 6260, U.S.N.M.²

¹*Fabricia infumata* Bigot. The type of this species has been examined by Dr. F. Brauer, who reports that it belongs to the genus *Parafabricia*. The form described under this name in my Revision of the Tachinidæ, page 144, will therefore require a new name, for which *pulpalis* is proposed. The third antennal joint is nearly ellipsoidal in outline, nearly twice as long as wide, as long as the second, arista thickened on the basal four-fifths, the last joint less than three times as long as the preceding, sides of face on the triangular upper-outer half covered with short yellow bristly hairs, mesonotum bluish gray pruinose.

Type.—Cat. No. 6234, U.S.N.M.

Jurinia metallica Desvoidy. Dr. Brauer has also studied the type of this species, and reports that it is evidently the same as *Jurinia histricoides* Williston. The species described as *metallica*, in my Revision, page 147, may therefore take the name of *adusta*, which is there given as a synonym of the former.

²The species described in my synopsis of the Tachinidæ, page 145, as *Epalpus nigripilosa* is not that species, but will form a new genus differing from *Epalpus* by having only a median discal and marginal pair of bristles on the second abdominal segment and only a discal pair and marginal row on the third; from *Gymnomma* it differs in that the ocellar bristles are wanting; third joint of antennæ nearly twice as long as the second, strongly convex on the upper side, black, the base and remainder of antennæ yellow, arista black, its penultimate joint over twice as long as broad, palpi wanting, eyes bare, thorax black, densely yellowish gray pruinose and with four black vittæ, scutellum yellow. The genus may be named *Parrepalpus*, new genus, and the species *flavida*, new species.

Family DEXIIDÆ.

MYOCERA BIVITTATA, new species.

Black, the second antennal joint, face, cheeks, and palpi yellow; antennæ three-fourths as long as the face, the third joint nearly three times as long as the second, arista rather long plumose, sides of face on the upper part golden yellow pruinose, and with a few short black bristly hairs, on the lower portion and the cheeks in certain lights very thinly whitish pruinose; cheeks two-thirds as broad as the eye height; proboscis one and one-fifth times as long as height of head, slender, rigid, labella small; body rather slender, gray pruinose; mesonotum with three, scutellum with one, first three segments of abdomen with two black vittæ, the latter united on the first segment; also a black vitta on pleura in front of each wing; second and third abdominal segments bearing only marginal bristles; hind tibiæ not ciliate, middle tibiæ bearing a single bristle on the outer-anterior side, front pulvilli greatly elongated; wings hyaline, gray at the base, veins bare, bend of fourth rounded and without an appendage, front calypter and base of the other white, remainder of the hind one brown; length, 7 mm. A male specimen collected August 17 by Mr. C. H. T. Townsend; received from Prof. T. D. A. Cockerell.

Habitat.—White Mountains, New Mexico (altitude about 8,200 feet).

Type.—Cat. No. 6235, U.S.N.M.

MEGAPARIA FLAVEOLA, new species.

Yellow, the mesonotum except lateral margins, and a median vitta on the abdomen black; base of scutellum brown; vertex one-third as wide as either eye, sides of face bare, cheeks slightly less than half as wide as the eye height, antennæ nearly half as long as the face, the third joint slightly longer than the second; arista black, its longest hairs only slightly longer than its greatest diameter; proboscis and palpi unusually short and robust; mesonotum gray pruinose, marked with three black vittæ; abdomen yellowish gray pruinose, the first three segments with marginal bristles; hind tibiæ not ciliate, claws and pulvilli unusually long; wings hyaline, third vein bristly halfway to small crossvein, fourth vein rounded at the bend and without an appendage, first posterior cell closed in the wingmargin, calypteres whitish; length, 8 mm. A male specimen.

Habitat.—Colorado.

Type.—Cat. No. 6236, U.S.N.M.

CHÆTONA FLAVIPENNIS, new species.

Black, the antennæ and palpi yellow, frontal vitta, cheeks, and lower part of sides of face, reddish brown; vertex of male one-sixth, in the

female one and one-fourth times as wide as either eye, one pair of orbital bristles in the female, frontals descending nearly to middle of second antennal joint, sides of face covered with rather short bristly hairs on the upper half, antennae from two-thirds to three-fourths as long as the face, the third joint in the male nearly twice, in the female one and one-half times as long as the second, longest hairs of arista nearly three times as long as its greatest diameter, cheeks one-seventh as wide as the eye height, proboscis very short and robust, labella very large; body densely yellowish gray pruinose, mesonotum with four indistinct darker vittae, three pairs of postsutural dorsocentrals, two sternopleurals, hairs of middle of dorsum of abdomen depressed, first segment without dorsal bristles, the following two with a marginal row of rather short ones; hind tibiae not ciliate, pulvilli of male elongate; wings and veins yellowish, third vein bearing two bristles near the base, fourth vein broadly arcuate at the bend, ending just above the wingtip, hind crossvein nearly midway between the small and bend of fourth; calypteres yellow; length, 9 mm. A specimen of each sex collected May 6, 1900, by Prof. James S. Hine.

Habitat.—Vinton, Ohio.

Type.—Cat. No. 6237. U.S.N.M.

Family ANTHOMYIDÆ.

PHAONIA PALLIDULA, new species.

Male.—Head black, face and frontal orbits whitish pruinose, eyes as widely separated as the posterior ocelli, frontal vitta obliterated for a short distance, antennae three-fourths as long as the face, dark brown, the first two joints and base of the third yellow, third joint nearly twice as long as the second, longest hairs of arista three times as long as greatest diameter of arista, hairs of eyes rather sparse, cheeks about one-fifth as broad as the eye-height, proboscis dark brown, slender and rigid, labella small and very narrow, palpi yellow, narrow; thorax black, bluish gray pruinose, marked with four indistinct blackish vittae, three pairs of postsutural dorsocentral bristles, one or two pairs of acrostichals, none in front of the suture; sternopleurals one and two; scutellum yellow, grayish pruinose, base of upper side broadly blackish; abdomen yellowish, varied with pale brownish, the last two segments largely of this color, wholly gray pruinose, viewed from behind discloses an interrupted blackish dorsal vitta, last two segments bearing a discal and a marginal row of bristles; venter yellow, an interrupted black vitta in the middle; legs yellow, front femora largely black, an interrupted pale brown band toward apices of the other femora, tarsi brown; middle femora bearing a row of rather long bristles on basal two-thirds of under side, the hind ones with two rows of rather long ones extending nearly whole length of

under side; front tibiæ bearing a bristle near middle of posterior side, middle tibiæ with one above and one below the middle of the posterior side, hind tibiæ with two near middle of inner-anterior, two near middle of outer-anterior, and one below middle of outer-posterior side; front pulvilli as long as the last tarsal joint; wings hyaline, costal spine minute, fourth vein diverging from the third; calypteres white, halteres yellow; length 7 mm. A male specimen collected by Mr. H. K. Morrison.

Habitat.—Southern Georgia.

Type.—Cat. No. 6238, U.S.N.M.

MYDÆA FLAVICORNIS, new species.

Head black, frontal orbits and face whitish pruinose, eyes of male almost contiguous, the frontal vitta obliterated for a short distance; antennæ yellow, arista at base yellow, the remainder brown, the longest hairs about twice as long as greatest diameter of arista, antennæ slightly shorter than the face, the third joint broad, nearly three times as long as the second; cheeks about one-tenth as wide as height of eyes, proboscis dark brown, short and robust, palpi slender, yellow; thorax black, gray pruinose, and marked with four black vittæ, four pairs of postsutural dorsocentral bristles, sternopleurals one and two; one pair of acrostichal bristles, hairs between dorsocentral bristles arranged in about eight irregular rows; scutellum yellow, the base usually brown, three pairs of marginal bristles, of which the basal pair is about half as long as the others; abdomen black, gray pruinose, the last two segments bearing discal and marginal bristles; femora, tibiæ, and tarsi yellow, bristles on under side of middle and hind femora, except on apical third of the latter, shorter than diameter of the femora; front tibiæ without bristles except at apex, middle tibiæ each bearing two near middle and three-fourths of the posterior side, hind ones bearing two below middle of anterior-inner and two near middle of anterior-outer side; wings hyaline, veins yellow, bare, fourth vein diverging from the third, hind crossvein nearly straight, small crossvein near two-thirds length of discal cell, costal spine wanting; calypteres yellowish white; length, nearly 5 mm. Two males and one female.

Habitat.—Rouville County, Quebec, Canada (May 24, 1900, Mr. G. Chagnon), and St. Louis, Missouri.

Type.—Cat. No. 6239, U.S.N.M.

CHIROZIA CAPITO, new species.

Male.—Black, the lower part of the front, extending along sides of facial ridges nearly to their lower ends, the halteres and bases of tibiæ yellow; face and frontal orbits whitish pruinose, front at nar-

rowest point nearly as wide as either eye, frontal orbits unusually wide, wider than frontal vitta at base, the latter strongly contracted above, at its narrowest point about as wide as lowest ocellus, head considerably inflated, three pairs of frontal bristles, proboscis rather slender, rigid, with small labella; antennæ three-fourths as long as the face, the second joint three-fourths as long as the third, arista almost bare, thickened on the basal fourth; body densely light bluish gray pruinose, unmarked; three pairs of postsutural dorsocentral bristles, sternopleurals one and two, scutellum bearing a subbasal and a subapical pair; abdomen depressed, narrow, hypopygium rather small, with a fissure slightly to left of median line, no ventral lobes; middle femora bristly on basal half of under side, the hind ones on nearly their entire length; front tibiæ bearing a bristle near two-thirds length of outer side and another below middle of inner-posterior side; middle tibiæ with one below middle of outer-anterior, one on outer-posterior, and two on median third of inner-posterior side; hind tibiæ ciliate, with rather short bristles on nearly the entire length of the inner-anterior and inner-posterior sides, and with about five larger bristles on the outer-anterior and outer-posterior sides; front pulvilli as long as the last tarsal joint; wings whitish hyaline, costa not distinctly spinose, costal spine about as long as the small crossvein.

Female.—Differs from the male as follows: Front twice as wide as either eye, frontal vitta only slightly contracted above, two pairs of orbital bristles and a cruciate pair of preocellars, second antennal joint about half as long as the third, abdomen broad at base, tapering to the tip; hind tibiæ bearing only two bristles on the anterior-inner side, none on the posterior-inner, front pulvilli about half as long as the last tarsal joint, costa with rather long spines.

Length, 4.5 mm. A specimen of each sex received from Mr. C. W. Johnson.

Habitat.—Manumuskine, New Jersey.

Type.—Cat. No. 6197, U.S.N.M.

Family SCATOPHAGIDÆ.

PSELAPHEPHILA SIMILIS, new species.

Head yellow, the occiput and three triangular spots on vertex black, gray pruinose; face, except its extreme sides, white pruinose, frontal orbits whitish pruinose, changing above to gray; antennæ black, first two joints and base of third yellow, palpi light yellow, proboscis black; body black, thorax densely, the abdomen thinly bluish gray pruinose, the abdomen somewhat polished; femora black, their broad apices and the tibiæ yellow, tarsi darker yellow; bristles of legs and body normal; wings grayish hyaline, the veins brown; halteres yellow; length, 4 mm. One male and seven females collected April 30, 1870; May 8, 1869,

and June 3, 1876, by Mr. Edward Burgess. Also a female specimen collected May 12, 1900, in Chambly County, Quebec, Canada, received for naming from Mr. C. W. Johnson, of Philadelphia, to whom it has been returned.

Habitat.—Beverly, Massachusetts.

Type.—Cat. No. 6240, U.S.N.M.

Family MICROPEZIDÆ.

CALOBATA VITTIPENNIS, new species.

Head reddish brown, whitish pruinose, lower part of front black and somewhat polished, followed by a velvet black fascia expanded in the form of a tooth in the middle below and also above on either side of the ocelli, vertex, except the ocellar triangle, steel-blue, polished; one pair of postvertical bristles, two widely separated pairs of vertical and one pair of orbital bristles; antennæ reddish brown, the third joint twice as long as wide, arista bare; clypeus and palpi reddish brown, proboscis dark brown; body bluish black, grayish pruinose, the humeri, propleura, and hypopygium reddish brown, two or three bristles in front of each middle coxa; legs dark brown, extreme bases of middle femora and two bands on their apical half yellowish, hind femora yellow, a broad median band and a narrower one midway between it and the apex brown, front tarsi except base of first joint whitish, changing to yellow toward the apex; wings grayish hyaline, slightly tinged with yellow along the costa, first posterior cell brown, this color encroaching on the submarginal cell at its apex and on the middle and upper part of the apical half of the discal cell; apex of first vein far before the small crossvein, last section of fourth vein one and one-fifth times as long as distance between apices of second and third veins, anal cell prolonged over halfway from the fifth vein to the wing margin; length, 6 to 9 mm. Four males and three females collected April 27 to 29 by Mr. C. H. T. Townsend.

Habitat.—Frontera, Mexico.

Type.—Cat. No. 6261, U.S.N.M.

Family TRYPETIDÆ.

SPILOGRAPHA FRACTURA, new species.

Yellow, an ocellar dot and band beyond middle of hypopygium black; face strongly retreating below, mesonotum subopaque, thinly gray pruinose, bristles of thorax and the four on scutellum black, short hairs of mesonotum chiefly black, abdomen polished, its hairs black; wings hyaline, a black spot fills stigma and crosses marginal cell, a black band begins at first vein above forking of the second and third and extends to apex of anal cell; a black cloud on small and

another on posterior crossvein, a brown dot below middle of penultimate section of fifth vein, a black spot midway between apices of first and second veins extending from costa to middle of submarginal cell, apex of wing from before apex of second vein to beyond apex of fourth broadly bordered with black, the inner edge of this border concave; small crossvein near two-thirds length of discal cell and noticeably beyond apex of first vein, third vein bristly nearly its entire length; length, 4 to 5 mm. Five males and three females.

Habitat.—White Mountains, New Mexico (8,000 feet elevation, Townsend), and Colorado (Morrison).

Type.—Cat. No. 6262, U.S.N.M.

CONTRIBUTIONS TOWARD A MONOGRAPH OF THE LEPIDOPTEROUS FAMILY NOCTUIDÆ OF BOREAL NORTH AMERICA.

A REVISION OF THE MOTHS REFERRED TO THE GENUS *LEUCANIA*,
WITH DESCRIPTIONS OF NEW SPECIES

By JOHN B. SMITH, Sc. D.,
Of Rutgers College, New Brunswick, New Jersey.

As it stands in our lists at present the genus *Leucania* includes all those species with hairy eyes and unarmed legs in which the vestiture is more or less hairy, the colors pale yellow or luteous tending to reddish, and the markings more or less strigate; normal noctuid maculation rarely complete. The antennæ of the male are simple or nearly so and the front of the head is without modification.

Setting aside a small series of narrow-winged, long-bodied forms as generically distinct under the name *Neleucania*, the remainder of the species agree in the somewhat robust body, moderate, not retracted head, long and functional tongue. The eyes are round, moderate in size, and the palpi reach the middle of front. These palpi are stout, hairy, the terminal joints short and obtuse. *Pilipalpis* is an exception, chiefly in the male. The thorax is usually quadrate, with collar and patagiæ fairly well marked; but in some series it is quite loosely clothed, with the parts undefined. The vestiture varies from thin hair, through flattened hair to a mixture of long scales and hair; the latter an unusual feature. Behind the collar centrally there may be a small ridge or crest, a small divided crest, or no obvious tufting at all.

The abdomen is untufted except at sides in the males. The vestiture on the under side is loose and woolly, the males being apt to have the legs sexually tufted.

The primaries vary somewhat in shape and may be quite stumpy or trigonate with marked or even acute apices.

The species occur throughout the United States and north as well as southward, though on the whole the genus may be said to be Northern rather than otherwise.

In the preparation of this paper my reliance has been first of all on the material in my own hands, which was more complete than that of

any other single collection. From the United States National Museum I had 100 examples, including all save type specimens. From Dr. William Barnes, of Decatur, Illinois, I had his entire material in the genus, peculiarly rich in some local Western forms. From Mr. W. D. Kearfott, of Montclair, New Jersey, I had a series of specimens illustrating a few special forms. The collections of the American Museum of Natural History were carefully compared and some undetermined material was loaned. The collection of the Brooklyn Institute of Arts and Sciences (Neumoegen and Graef collections) was compared and specimens were loaned from it. From the collection of the American Entomological Society several specimens were secured. The Strecker material was carefully compared, and in addition, several correspondents sent me examples that will be specifically acknowledged later on.

Within the limits of the genus proper the species range themselves into a number of small or larger groups, some well, some ill defined, and in one or two cases not altogether easily separated on other than sexual characters. It might be put in a somewhat different way as a number of well-marked species, some of which remained true to type, others of which diverged and gave rise to forms which are not yet altogether well marked.

A somewhat well-defined series may be typified by *unipuncta*, in which there is a sharp ridge or crest behind the collar, not very prominent to be sure, but always recognizable in good examples. As additional characters we have the trigonate, pointed primaries in which both the ordinary spots are at least traceable, and the character of the male genitalia.

The group consists of only two, very unlike species, one of which is known in the female only.

Lutina differs from all our other species in that it has both the ordinary spots outlined by yellowish rings, the median lines complete, and the subterminal line obvious. In other words, the normal noctuid maculation is complete. The only example known to me is from Florida and is a female.

Unipuncta has the ordinary spots on the primaries paler, but not ringed, so that they are obvious, but not defined. The median lines are punctiform, and in some specimens both are completely traceable. Usually, however, the transverse anterior line is lost in the general powdery character of the wing, and sometimes the transverse posterior line shares the same fate. The general color is a variable shade, reddish or fawn gray or brown, sometimes with a little admixture yellowish. The surface is speckled with black, forming a dark oblique subapical shade and a dusky shading along the median vein, at the end of which is a single white dot.

The secondary characters of the male consist of moderate fringes of

all the femora inferiorly, and with outward fringes of long hair on the tibiæ, forming no tufts in either case; but those on the middle pair more prominent than any of the others. In the antennæ there is a longer bristle on each side of each joint.

The male genitalia are unique and rather simple. The harpes are somewhat narrow at base and, at a little less than half their length, divide into a broad inferior lobe and a narrow superior continuation, which again enlarges into a broad rounded tip, the inner surface of which is set with short, stiff, pointed spines. The clasper is a small, curved claw or beak at the point where the harpes divide.

In all the other species there is either no obvious tufting of any kind behind the collar or there is a small divided crest.

In the group *pseudargyria* we have two species with robust bodies and comparatively short, obtuse primaries, in which both the ordinary spots are marked and the transverse posterior line is composed of a double series of venular dots. Both are reddish luteous in color and are more or less black powdered.

Pseudargyria has the abdomen conspicuously tufted in the male, and the genitalia have dense hair and scale tuftings. The legs in the same sex are very prominently tufted, the most conspicuous clothing being on the anterior pair. The coxa has a tuft of long, curly scales on the outside. The femur has a bunch of thick blackish hair inferiorly, longest toward the tibia, capable of brush-like expansion. The tibia has a dense covering of black hair capable of fan-like expansion exteriorly—altogether a very striking modification. The middle leg is rather shorter and stouter than usual; femur with a fringing of long hair inferiorly; tibia set with long hair on all sides so as to form a prominent loose brush, not capable of fan-like expansion. In the posterior leg the femur is fringed with long hair inferiorly, but not so much as on the others; the tibia with a clothing of thin hair on all sides, not forming an obvious brush.

The genitalia resemble those of the group *communoides*. The harpes are very broad at base and narrow only a little inferiorly for nearly two-thirds their length, then they are cut off abruptly from below to form a narrow, oblong, obliquely rounded tip. This oblique tip is set with long, rather stout bristles. At the point on the upper margin where the oblong tip joins the broad body of the harpe there is a curved elevated ridge with the margins turned in, forming a crater-like cavity with the outline incomplete. The clasper is a moderately long and stout cylindrical hook, not much curved, arising from the inner portion of the crater over a broad, irregular, corneous plate.

The species occurs east of the Rocky Mountains throughout the greater portion of the United States and Canada.

Ptilipalpis is obviously related to the preceding in appearance, but has a prominent diffusely margined black shading from the reniform

to the transverse posterior line. I have only a female at hand, but Mr. Grote's type was a male. He compares it with *pseudargyria*, states that it does not have the exaggerated tufts on abdomen and tibiae, and adds that it has "a curious fan-shaped tuft of spreading hair arising from the upper surface of the second joint of the unusually prominent palpi."

This character is distinctive and will serve to differentiate the male from all others of our species. The female is readily recognizable by the blackish shade already described. All the known specimens are from Florida.

Subpunctata stands by itself, but in many points resembles *unipuncta*. It is decidedly smaller, has somewhat narrower primaries, but of the same shape, and has the dark shading over the median vein, relieved by a single white dot at the end of the cell.

In other respects the type of maculation is the same, but the color in *subpunctata* is darker and it is closely *strigate* with blackish on the veins and in the interspaces. The secondaries are white at base, semi-translucent, with a smoky outer border. Behind the collar is a distinct divided thoracic crest, and this separates the species sharply from *unipuncta*.

In the male the anterior legs have a fringe of black scaly hair on the coxæ; the femora have a dense fringe of shorter scales; the tibial vestiture is short, dense, and not prominent. On the middle leg the femora have a moderate fringe of not very long hair; the tibiae are set with moderate hair on all sides, but it is neither very dense nor brush-like. On the posterior leg the femora have a moderate fringe basally and the tibiae have thin, scant, longer hair.

The male genitalia are characteristic. The harpes are very broad basally and beyond the middle narrow abruptly and evenly from both margins to about one-fourth their previous width; beyond that they broaden gradually to a slightly rounded tip which is furnished with a series of six long bristle-like hairs set in conspicuous pits. The clasper is an irregular corneous plate from which arises a short, cylindrical, nearly straight spur and two lower, somewhat curved, pointed processes; quite unique in the genus.

Dr. Strecker's species *complicata* is a small example of this species, whose home is in Texas and New Mexico.

Pullens is typical of a rather well-defined group in which the vestiture is thin and hairy, forming no obvious tufting on the thorax and leaving the collar and patagiæ not or but feebly defined. There are no lines or other marks on the collar and none on the thorax. The primaries are normally trigonate, with marked but not acute apices, without longitudinal dark lines or obvious discal spots, the median line usually rarely well marked, and the transverse posterior line reduced to two black dots. The secondaries tend to

blackish on the disk, leaving the margins white. In the male, the leg tuftings are not prominent, the femora fringed inferiorly and one or more pairs of tibiae with longer hair, forming no tufts. The male antennae have single, slightly longer lateral bristles on each joint.

The male genitalia are quite characteristic, and all the species resemble each other closely in this particular. The harpes are broad at base and broaden to the middle, where they are suddenly narrowed from below, the upper margin being continuous. Beyond this they broaden again into a rounded, lappet-like tip, the inner side of which is closely set with pointed spines of moderate length. The clasper consists of two processes from the same base; one is cylindrical curved upward, hook-like, with an obtuse tip; the other is bent outward and curved downward, rather beak-like in character, the tip usually obtuse.

While the group itself is thus well defined and rather sharply separated from the others, the species within the group are very closely allied.

In the first place, comparing all accessible examples of the true European *pallens*, I do not find any American examples that entirely agree with any of them. The American examples, which I term *luteopallens*, are uniformly less strigate, uniformly brighter, and, on the whole, with whiter secondaries. There is quite a marked difference in the genitalia, comparing five pairs of the American with three pairs of the European form. In the latter the harpes are quite prominently angulate on the superior margin and the upper angle of the tip is quite obviously marked. The spinulation of the inner side is also less abundant and shorter. The lower clasper is broader and more spatulate in form than any American specimen. The alliance is close, but as species go in this group *luteopallens* is not the same as *pallens*.

The femoral fringes of the male are very moderate and the hind tibiae only have a little longer hair fringing above the middle. In this respect *pallens* agrees with *luteopallens*, which inhabits the Atlantic coast region.

Minorata is smaller and darker throughout, the secondaries in particular being blacker on the disk. The primaries have a broader, more stumpy appearance, due to the comparatively stouter body. In reality *minorata* is much more closely allied in appearance to *pallens* than is *luteopallens*; and this is also marked in the male genitalia, which are intermediate between those of *pallens* and *luteopallens*, while really distinct from both. The leg tuftings are much better developed, however, than in *luteopallens*, especially on the anterior and posterior tibiae, which have an obvious fringing of long hair.

This species ranges along the Rocky Mountain region from New

Oxygale is somewhat larger and broader winged than the previous species, and has a grayish shading over the luteous base. The streakings are very fine and not contrasting, giving the whole insect a very even appearance. The secondaries are entirely blackish except along the costa, or there is only a narrow whitish edging along the outer margin.

The male genitalia are exactly as in *luteopallens*, but the leg tuftings are even more marked than in *minorata*. In this species the middle tibiae also are furnished with fringes outwardly, so that all are now fringed. The range of this species is from the middle Rockies southward, west to the Pacific coast, and throughout California.

Rubripallens differs from all the other species in this group by the reddish shading over the primaries. This is given by the reddish streakings over the yellow base, the paler veins being thereby more than usually relieved. The secondaries have a yellowish tinge and vary from this to a transparent smoky, the disk being always more or less blackish. The range of this species is from the middle Rockies into Utah.

The genitalia of the male do not differ from those of *luteopallens* and the leg tuftings are very like those of *omygale*.

Pertracta Morrison belongs in this series, but I doubt its being an American insect. The type is in the Strecker collection, and, while the wings are perfect, the body is crushed as though it might have been papered. The locality given on the label is "Pennsylvania," and I have understood Dr. Strecker to say it came from a Philadelphia collector, whose name he did not give. I believe it to be an unusually well-marked *pallens*, with a reddish tint, a little discolored in the relaxing jar; in other words, a European specimen. Mr. Morrison was in several cases misled as to the source of his specimens, and I believe that in this case Dr. Strecker was also imposed upon. I can scarcely credit the occurrence near Philadelphia of a good species so like *pallens* and so rare that in twenty-six years not a specimen has been captured by any of the Philadelphia collectors.

In tabular form the species of this group may be separated as follows:

Light creamy yellow, streakings not contrasting; secondaries with a small discal area blackish	<i>luteopallens</i> .
Darker, with a luteous tinge; streakings more obvious and somewhat contrasting; secondaries with more of disk blackish	<i>minorata</i> .
Pale grayish luteous; streakings not contrasting; secondaries all blackish except the margins	<i>omygale</i> .
Reddish luteous, obviously streaky; secondaries with a yellowish tinge, smoky or blackish shaded	<i>rubripallens</i> .

The group *albilinea* comprises another series of closely allied species which may be separated out with a little care and a fair material to work with. Superficially all the species agree in having the lower

half of the collar white, or at least much paler than the upper portion, and, in good examples, white lines on the patagiæ. The wings are normally trigonate, of moderate length, the apices well marked, though scarcely acute. The median vein is white, and the white streak tends to continue in the interspace between veins 3 and 4. Below this white shade is a more or less diffuse red, smoky, or blackish shade which extends to the end of the median vein. Above vein 4 from its inception a red, smoky, or blackish triangular shade extends, starting as a point and broadening outwardly until, on the outer margin, it fills the space between vein 4 and just below the apex, where it again ends in a point.

These characters of maculation are quite obvious and are easily recognizable; but the male genitalic characters are equally strong and equally distinctive. The harpes are moderately broad at base, oblong to a point well beyond the middle, and there abruptly narrowed from below. The narrow extension from the upper margin is obtusely bent downward and then suddenly enlarged into a hatchet-shaped tip; the outer edge with a fringe of spinules directed inwardly. This is characteristic of the group, and occurs nowhere else in the genus. The clasper is usually divided into three processes, of which the lower is more or less spatulate or ligulate; the upper flattened or round, shorter and stouter; the median is a longer, more slender, usually pointed spur. The upper and lower processes are from the same base, the central structure arises separately.

As to leg structure, in the males the species as a whole agree in having long, thin, hairy fringes on the under side of all the femora. The anterior tibiæ are variably fringed outwardly and the tufting is obvious. The median tibiæ are not obviously tufted. The posterior tibiæ are variably furnished with long thin hair, tending to real tufts. Generally speaking, the northern forms are not so obviously tufted as are the southern species.

The male antennæ are barely ciliate and do not have longer lateral bristles on the joints.

Rubripennis differs from all others in this series and in the genus by having all the darker shadings bright, pinkish red. The male genitalia while after the group type have the claspers quite different from those of any other species. The lower process is long, cylindrical, and pointed; the upper a broad, short beak.

The home of this species is in Texas, but it extends northward into Missouri.

Albilinia has dark smoky or black secondaries in both sexes, which may be a little lighter at the extreme base only. It is on the whole a small species, the primaries dark luteous in ground and the smoky shades broad and diffuse. The discal dots may or may not be prominent.

The male genitalia are of the characteristic form, with all the processes well developed.

This form has a wide distribution, ranging in my material from southern Arizona to New Jersey.

Obscurior resembles the preceding in size and in the dark color of the primaries; but the maculation is more even and the discal spots are absent. The secondaries are whitish to the middle or beyond, the margin diffusely smoky.

The genital structure is like the preceding and the form may be only a local variety. But it comes from Manitoba, and I have found this faunal region so well marked that I risk the name, based chiefly on the more even color of the primaries and the partially white secondaries.

Diffusa is a markedly lighter colored and larger species, the secondaries white, with a diffuse smoky outer margin varying in width. The dark areas of the primaries are much smaller and much better defined, the terminal space tending to become leaden gray. There is no difficulty at all in separating out this form from both of the preceding.

The male genitalia are distinctive chiefly by having the superior process short, blunt, and cylindrical, like a thumb, while the lower process is quite flattened. There are other differences in detail which may be better understood by a reference to the figures herewith given.

This is the most widely distributed form, Walker's type, coming from Nova Scotia, while Mr. Druce figures a specimen as coming from near the City of Mexico.

The other species in this group agree in having the secondaries entirely white.

Limitata is from Texas and has the brown shading to the white median vein on both sides of it—that is, there is a narrow brown shading that begins near the base of the cell itself, margins the vein on each side, and, beyond it, continues into the brown subapical shade.

The male genitalia have the superior process flat and squarely terminated, the inferior more obviously spoon-shaped than in the other species.

Federal differs from the preceding in that the median vein is not obviously whitish, and there is no dusky shade above the median vein. The dusky shadings are well marked, but a pinkish shading is introduced along the costa and in the submedian interspace. The discal spot is marked in all the specimens, and is also present in the preceding species.

In the male genitalia the species is the most aberrant of the group. The upper process of clasper is altogether lacking; the lower process is cylindrical, finger-like, and the middle hook is only moderate in length, a little curved and pointed at tip. The tip of the harpes is

also quite different from the allied forms, and altogether this proves itself a good species without doubt. It is from Arizona.

Neptis resembles *diffusa*, but the secondaries are entirely white, the dark shadings on the primaries are much reduced, much more even, and the discal spot is absent in most cases.

The genitalia are practically like those of *diffusa*, but the lower process of clasper is a little more scoop-shaped at tip, and the tip of the harpe is somewhat more narrow and pointed. Otherwise in all respects the resemblance is very close. All the specimens are from Colorado.

Taken together the species recognized here make an unusually compact group, from which *rubripennis* stands out at once by its red color. *Albilinea* and *obscurior* are small, very dark species in which the secondaries are smoky or pale only at base. The latter may easily be a local variety of the former.

Diffusa is larger and paler, with the secondaries white except for the smoky dusky margin, which varies greatly, and *neptis* may be a local variety in which the smoky tinge disappears altogether.

Limitata is a good species with white secondaries, in which the median vein is margined on the upper edge.

Tetera is well marked by genital structure and by the tendency to pink tinging in the costal and submedian regions of the primary.

In tabular form the differences appear as follows:

- | | |
|---|----------------------|
| 1. Primaries with the darker shadings pinkish red..... | <i>rubripennis</i> . |
| Primaries with the darker shading smoky or blackish | 2 |
| 2. Secondaries white at base, smoky toward and at outer margin | 3 |
| Secondaries white | 4 |
| Secondaries black | <i>albilinea</i> . |
| 3. Size small, colors dark, secondaries translucent at base, smoky margin broad. | <i>obscurior</i> . |
| Size larger, colors much lighter; secondaries white except for a smoky outer margin, which is narrow or very narrow | <i>diffusa</i> . |
| 4. Median vein white, with a brown margin on each side..... | <i>limitata</i> . |
| Median vein not obviously white, without dusky margin above | 5 |
| 5. Discal dot obvious; a pinkish shading on costa and in submedian interspace .. | <i>tetera</i> . |
| Discal dot wanting or obscure; shadings reduced, even, not pinkish | <i>neptis</i> . |

The group *ligata* is composed of three very closely allied species, which agree in rather small size, somewhat frail body, close, somewhat scaly vestiture, and a slightly convex thorax, in which the collar and patagiae are not well marked. The collar has a single transverse line across the middle.

The primaries have the costa and inner margin convex, the outer margin oblique and somewhat rounded. A dusky median shade extends from base to outer margin over the median vein, which is partly white. This, with the small size and rather slight form, makes the characteristic feature in the species. The transverse posterior

line is punctiform and, in general, is complete or at least completely traceable.

Ligata has a distinct pinkish shading, and the surface is obviously black powdered. The markings are rather well defined and the transverse posterior line is generally complete. The species is from the South and Southwest.

Flabilis is exactly like *ligata* except that the pinkish tinge is less obvious and the punctate transverse posterior line is not quite so well marked. It is from Long Island.

Rimosa is *ligata* with all the markings more obscure.

It is more than probable that all these are slight local varieties of one species which is not uncommon southwardly, but becomes very rare as we go north. Of *rimosa*, Dr. Thaxter was good enough to send me a male, which he compared with the type in his possession, and besides these two examples I know of none in collections. Years ago Mr. Tepper took two examples on Long Island, which formed the types of *flabilis*. One of these is now in the British Museum and one is at the agricultural college in Michigan. I have an example compared with the British Museum type, and, by the courtesy of Prof. R. W. Pettit, I was able to compare the other type as well. There are no other specimens known to me as *flabilis* in collections.

The male genitalia are exactly alike in all three forms. The harpes consist of a broad, oblong basal piece from which a narrow oblong process, rounded at tip, extends superiorly. The inferior angle of this broad basal piece is drawn out into a sharp point. At the rounded tip there are two long, spine-like hairs, but no other armature. At the extreme base of each harpe is a long, stout, somewhat curved, and irregularly toothed chitinous process. The clasper forms one slender, cylindrical superior finger and two stouter, more beak-like, parallel, pointed processes.

The leg tuftings in the male show no strongly marked characters, the femoral tuftings and fringes being scarcely more obvious than in the females. The antennal ciliations, however, are well marked. It is scarcely needful to attempt the separation of these forms by means of a table.

The group *insuata* is composed of species with short, stumpy wings, robust body, the thorax quadrate, with a divided crest behind the collar, the latter being well marked and with transverse darker lines. The patagiae are also well defined and a little uplifted. The vestiture is coarse and the species have a roughly powdered appearance, due to a speckling of black. The ground color is a dull grayish luteous with a tendency to reddish which is dominant in *insuata*. The primaries have a streaky appearance, the veins being usually lighter than the margins and in the interspaces a dusky streak is usually obvious. The median vein is usually white or at least paler, but there is no well-

defined dusky shade accompanying it inferiorly. There may be a dark or black basal streak, but this extends into the interspace and not along the vein. There is no black discal dot, though in some examples a few black scales help to define the white dot inwardly. The punctiform transverse posterior line is complete and sometimes tends to become geminate.

The legs in the males of this group have the sexual tuftings best developed in *heterodoxa*. The anterior femora are fringed beneath with long dense hair, about as long at base as at tip, and forming no tufts; the tibiæ are not modified. The middle femora are fringed for their entire length, but the hair at base is very much longer than that at tip; the tibiæ are outwardly clothed with very dense hair, thickest at the middle, but forming no expansible tufts. The posterior femora have a thin, moderate fringing at base only; the tibiæ have a small fringing of hair outwardly.

In *dia* the development is about the same; in *insueta* it is not quite so well marked, and in *megadia* it is so reduced that there is not much difference between the sexes.

The genital structure is similar in type in all the species; but no two are quite alike. The harpes at about the middle are suddenly constricted from below and continued along the superior margin into a more or less long-oval tip. There may be one, two, or half a dozen long bristle-like hairs at the edges of this tip. The clasper is made up of two parts; a flat long plate, the margins rolled over on the upper edge, and at tip the upper angle is drawn out into a sharp curved hook. From this plate arises a long, cylindrical finger-like process directed obliquely upward and outward and extending well beyond the upper margin of the harpes.

Only in *dia* are the lateral bristles of the male antennæ in the least marked.

Dia is the smallest of the species, the veins all white marked and no obvious black markings anywhere in the wing. The species is from California.

Megadia is somewhat larger, much better marked, the dark shadings obvious; a black or blackish curved basal streak extending into the submedian interspace. It extends along the mountain ranges from Arizona into British America.

Heterodoxa is again larger, markings fully as obvious as in the preceding; but there is no curved basal dash and the punctiform transverse posterior line is more obvious. The male genitalia also show an obvious difference as compared with those of the preceding two forms and resemble more nearly the following. It extends throughout the northern United States to the Pacific coast.

Insueta is perhaps a little larger on an average than *heterodoxa*, and decidedly reddish in color, varying somewhat, however, on this point.

The streakings are more prominent than usual and, altogether, it has all the group characters better and more completely developed than any other species. The black basal streak is obvious in this species.

In tabular form the species separate readily, as follows:

Primaries without a basal black streak.

Size small, all the markings obscure; veins white, not obviously relieved by darker streakings; secondaries whitish, even *dia*

Size larger, all the markings obvious; veins relieved by definite streakings; secondaries outwardly blackish or smoky, not even *heterodoxa*

Primaries with an obvious curved black or blackish basal streak.

Size small, primaries more obtuse; color luteous dull gray, rarely shaded with red *megadua*

Size large, primaries a little more pointed; color reddish gray, shading into brick red *insuetu*

The species *extincta* is entitled to rank as a group by itself because of its rather narrow primaries which are acute at the apex, a little incurved below, and form an obvious obtuse angle below the middle of the wing. The thoracic vestiture is rather fine and thin, forming no obvious tufts and relieving neither collar nor patagiæ; the collar is crossed by two transverse lines. The primaries are very obviously streaky, while the lines are not contrasting; there is a white point relieved by a few black scales at the end of the median vein and the transverse posterior line is bent very strongly inward below the middle.

In some respects the species resembles the *ligata* group, but the wing form differs materially and the sexual characters are more nearly like *phragmatidicola* through *juncicola*.

The leg tuftings in the male are not well developed. There is the usual fringing on the femora, much reduced and a little thickening of the vestiture on the middle tibia; nothing like a well-developed tuft.

The genitalia of the male consist of very broad, irregularly oval harpes from the upper margin of which very narrow tips extend. The end of each tip is somewhat rounded and set with long, slender, bristle-like hair. The clasper consists of a broad chitinous plate from the upper angle of which come two curved corneous processes. One of these is cylindrical, hook-like, and extends downward; the other is beak-like and is directed upward, extending beyond the upper margin.

The male antennæ have single longer bristles laterally on each joint.

The species is not easily mistaken and occurs along the Atlantic coast to Maine.

Leucania juncicola also stands by itself on genital characters, but superficially it resembles the group *phragmatidicola* very closely. The body is robust, thorax quadrate, collar and patagiæ well marked. The collar has a series of transverse lines of different colors, culminating in a broad purplish band below a narrow whitish tip; the band made up of three narrow bands of black, blue, and brown. The little tuft

behind the collar is also purplish. Transverse posterior line punctiform usually reduced to two dots only; a black dot in the submedian interspace. Secondaries more or less smoky.

L. multilinea of the next group resembles *juncicola* quite nearly, but has white secondaries and a less prominently lined collar. It also lacks the black dot in the submedian interspace, hence the differentiation is easily made when the two are at hand together. In the male the prominent tuftings of *multilinea* are at once distinctive. All the specimens of *juncicola* seen are from Texas or Florida.

The leg tuftings of the male are not especially marked. The femoral fringes are much as described for the group *insueta*, but are not so long or so well developed. The tibial tuftings are obvious, but not prominent; also like *insueta* in general type.

The male genitalia are unique. The harpes are very broad, almost triangular in shape, the angles broadly rounded, the upper outer margin prolonged into a narrow, parallel process, rounded at tip. At the point of junction with the basal portion is an elevated slightly rounded ridge, toothed at the edges. The narrow process is closely set at tip and along its inferior margin with long bristle-like hair arising from definite pits. The claspers arise from the upper outer angle of a broad chitinous plate; one of them is beak-like and curves down, almost parallel with the edge of the plate; the other is a slender cylindrical process a little enlarged above the middle.

The male antennæ are practically simple.

The group *phragmatidicola* consists of yellow or reddish luteous species with moderately elongate trigonate primaries in which the apices are at least well marked if not pointed. The body is quite robust, collar and patagiæ well marked, and in good specimen an obvious little divided crest anteriorly. The collar has one, two, or even three transverse lines, but these do not culminate in a purplish band. In the type form the median vein is white, margined with a black or dusky shading; there is a triangular dusky shade based on vein four, extending nearly to the apex, and this is traceable in all save the palest forms.

The leg tuftings in the male are so variably developed that it is deemed best to refer to them under specific headings.

The primary sexual characters of the male are distinctive; very similar for the species as a whole, yet with plenty of difference in detail, easily determinable by a comparison of the figures herewith given.

The harpés are broad at base, narrowing a little on the inferior margin until, at about two-thirds from base, they are abruptly cut so as to form a trigonate lappet, continuous on the upper margin. On the lower margin and at tip are a series of long, stiff hairs set into pits. At the junction of this outer narrow process is a disk-like, semicircular plate with incurved edges, which seems perforated with a varying num-

ber of openings, no two species being quite alike. Then there is a broad chitinous plate from the upper outer angle of which come two processes. One is long, curved, beak-like, pointed at tip, and extends downward; the other is short, cylindrical, and extends upward over the base of the first. Sometimes a third process comes from the lower outer angle of the plate and sometimes the inner inferior angle is obtusely extended. In some species a flattened process extends over the chitinous plate from the thickened upper margin, and this may or may not be perforated.

The species of this series are not difficult to separate if both sexes are at hand. A male can be placed without difficulty at all times, and a good female may be generally determined by the tables so nearly as to make identification easy from the descriptions.

Two main, though unequal, divisions may be based on maculation, though they are not entirely natural. In the majority of the species the median vein on the primaries is white, in whole or in part, and along this vein, above or below, or on both sides, is a black or smoky line or shade extending to at least the end of the cell. While this character is very unequally developed, it is at least obvious in every reasonably good example, and separates the species possessing it from the smaller series, in which, while the vein may be white, or at least pale, there is no defining shade or line. Such species as lack the defining shade have no obvious maculation of any kind and are almost uniform, except for the slight differences between the interspaccal streakings and the veins.

In the first series *multilinea* stands alone, because in the male the anterior tibiae are most heavily tufted with dense masses of discolored hair and scales capable of expansion. The antennae also, in this sex, have longer lateral ciliae than in any other species. It is a medium-sized or small form, the primaries light yellow, prominently streaked in the interspaces, and the collar white, distinctly banded. The secondaries are white, scarcely soiled even in the female. The transverse posterior line is usually reduced to two small black dots, and this, in combination with the white secondaries, prominent streakings, and small size, will differentiate the species even in the female.

In all the other species of this group, as well in the second as in the first division, the middle leg is the one most obviously tufted in the male. But this character varies greatly, and in a few instances there is only a marked thickening of the vestiture, rather than a brush or tuft.

Commoides and *phragmatidicola* have the sexual tuftings most prominent, and, in addition to the dense mass of vestiture on the middle tibia, that member is somewhat shortened and the outer spur is flattened and curved, the tip acute.

Commoides is a very stout, reddish-streaked form, with smoky-brown secondaries, and this differentiates the species at once from

all others in the series. The streak margining the pale median vein is black, there are black streaks along the inner margin and outwardly, and the streakings between the veins tend to become black. The sexual tuftings tend to become discolored, and the harpes of the genitalia are densely clothed on the outside with long yellow hair intermixed with broadly flattened scales. This prominent mass of vestiture can be somewhat expanded, but seems to form no real tufts or brushes of hair. There is at least one pair of longer pencils between the claspers at the base of the uncus, and these are probably capable of fan-like expansion. The species occurs throughout the eastern United States and Canada to New Mexico.

Phragmatidicola is altogether different in appearance and varies much more. It has a wide distribution and the variations are somewhat local. The primaries are narrower, more trigonate, and the apices more pointed than before. The ground color is pale luteous and the streakings are reddish between the light or dark veins. The dusky shading over the median vein may be smoky or blackish, and as a rule both sides of the vein are margined. The series of punctiform spots marking the transverse posterior line is usually complete though never very prominent, and there is usually a lighter shade through the cell and obliquely to the apex.

The sexual tuftings are very much as in *cominoides* but less discolored and somewhat less prominent. The secondaries are white, tending to become a little smoky on the veins and outwardly. The species occurs from the Atlantic to the Pacific and from Canada to Florida.

In all the other species of this series the outer spur on the middle tibia of the male is cylindrical, straight, pointed at the tip and either short or very short.

Imperfecta stands by itself because of its dark smoky gray color, which is neither powdery nor obviously strigate. It has somewhat the appearance of an undersized, dark *unipuncta* with the powderings out, and this is emphasized by the fact that the black or blackish longitudinal shading covers the median vein almost to the end of the cell; leaving only a short, white, angular spur to emphasize the usual black point. The secondaries are whitish, with a tendency to smoky margins. The sexual tuftings are not prominent and the antennal ciliations are small, not longer toward the tip.

The species has been thus far received from Arizona only.

Anteroclara resembles *phragmatidicola* in appearance very closely. With males for comparison there can be no difficulty, of course; but there is a real difference in superficial characters, though it is difficult to locate in one word. As a whole, the species is a little larger, a little broader winged, with somewhat less pointed primaries. It is more yellow in color, less streaky in appearance, the black dot at the end of the median vein often wanting, never prominent, transverse pos-

terior line reduced to two small interspaceal dots, and the upper margin of the pale median vein not in any way relieved. The secondaries, especially in the female, have a smoky appearance, and altogether this seems a duller, more even species than its ally. Besides the difference in the tibial spurs, the sexual leg tuftings of the male are much reduced in *anteroclarus* and the anal tuftings are not at all prominent. The specimens are from Calgary, Vancouver, and the Northwestern United States.

Calgarianus is like *phragmatidicola* in size and appearance, except that the color is very decidedly reddish. The white median vein stands out in strong contrast, and in most of the specimens the black margining shade is very distinct. From *phragmatidicola* the sexual characters separate this species; from *anteroclarus* the narrower, more pointed primaries and the color serve as distinctive characters. The secondaries are white in both sexes, the female only with a little fuliginous shading and somewhat smoky veins.

Thus far the species has been received from Calgary only.

Stolata is altogether different in appearance. The secondaries are snowy white, opaque, and the primaries are straw yellow. The white median vein is well marked, as is the dark shading beneath and beyond it between veins 4 and 5.

Only the female, from "Arizona," is at hand at present.

Oregona is like a very small *phragmatidicola*, more grayish red in color and with semitransparent white secondaries, in which the veins are hardly darker, and there is only a narrow smoky border at the base of the fringes. The secondary sexual characters are much reduced in all respects. The only locality, thus far, is Corvallis, Oregon.

With *roseola* begins a small group of species in which the median vein of the primaries, though it may be white or paler, is not margined or accompanied by any dusky shading. In fact, the wings are practically uniform except for the slightly darker interspaceal streakings which are characteristic of the genus. The shadings, which are so well defined in the typical species of this series, are here reduced to vague, dusky clouds, whose location must be understood that they may be recognized. In all of them the secondaries are white, the veins hardly darkened except in the female, in which, also, there may be a slightly dusky tinge.

Roseola, as its name implies, is reddish in tint. It is like *calgarianus* with all the contrasts out; but is somewhat larger and seems broader-winged than that species. It was originally regarded as a color variety of *farcta*, and has all the characters, except color, of that species. It seems to be not uncommon in the Northern Pacific States and in British Columbia.

Farcta is pale creamy yellow where the preceding is reddish, and is even larger in size. It is *anteroclarus* with all the dark shadings out

and the secondaries white. The sexual tuftings are very moderately developed and nowhere prominent. All examples thus far seen are from middle and southern California.

Palliseca is decidedly smaller, with narrower, more pointed wings, the primaries having lost almost all trace of maculation. The species occurs in the mountains of Colorado and in southern California; probably in the intermediate region as well.

In tabular form the species may be arranged as follows:

1. Median vein white or pale, accompanied by a black or darker shade more or less prominent, but always obvious..... 2
Median vein paler or concolorous, not margined by an obviously darker shade. 9
2. Male with the anterior legs most heavily tufted; tibiae with dense long hairy and scaly vestiture capable of fan-like and brush-like expansion 3
Male with anterior legs least modified; the tibiae not tufted..... 4
3. Male antennae lengthily ciliated; primaries creamy yellow with narrow dark streaks in the interspaces; secondaries white in both sexes *multilinea*.
4. Middle tibiae of the male heavily tufted, the outer terminal spur curved and flattened, pointed at the tip; lateral ciliations of the antennae prominent toward tip; anal tufts very large..... 5
Middle tibiae of male tufted, but not prominently so; outer terminal spur short, straight, cylindrical; antennal ciliations not prominent and not longer toward tip; anal tufts moderate..... 6
5. Very robust, wings shorter; primaries reddish, very streaky; secondaries fuscous brown, even, leg tuftings of male discolorous..... *commoides*.
Less robust, wings longer, more pointed; primaries with narrow reddish streakings over a pale luteous base; secondaries white with a smoky outer band and veins *phragmatidicola*.
6. Secondaries with veins and margins obviously smoky, the female darker than the male 7
Secondaries white, the veins faintly or not at all marked..... 8
7. Primaries smoky gray over reddish, not obviously strigate; the white shade on the median vein obscured to near the end of cell *imperfecta*.
Primaries red over a luteous base, the black shade beneath the median vein very prominent *calgarianna*.
8. Primaries straw yellow, scarcely strigate, transverse posterior line wanting; secondaries snowy white, opaque..... *stolata*.
Primaries reddish gray over yellowish; strigate; veins blackish lined; transverse posterior line punctiform, complete; secondaries semitransparent..... *oregonus*.
9. Primaries reddish, so narrowly strigate as to seem almost even; secondaries white with a yellowish tinge, the veins smoky. *roseola*.
Primaries very pale luteous, strigate with darker luteous; size large; wings broad; secondaries white with the veins yellowish *farcta*.
Primaries as before, but with the markings hardly obvious; size smaller; primaries narrower, more trigonate, more pointed at apex; secondaries white ... *palliseca*.

Having given in a general way the essential characters of the groups and of the species to be referred to them, it remains to differentiate the groups before taking up the species individually.

1. Thorax with a sharp ridge or crest behind the collar, ordinary spots present on the primaries..... Group *Unipuncta*.
Thorax with a divided crest behind the collar or without obvious tufting of any kind 2

2. Ordinary spots both obvious, transverse posterior line of primaries geminate.
 Group *Pseudargyria*.
 Orbicular always absent; reniform reduced to a black or white dot or altogether wanting..... 3
3. Collar without marking of any kind.....Group *Pallens*.
 Collar white inferiorly, or at least much paler than upper half....Group *Albilinea*.
 Collar with transverse lines of different colors, culminating in a broad purplish band below a whitish tipGroup *Juncicola*.
 Collar with one, two, or three transverse dusky lines..... 4
4. Primaries narrow, elongate, apex acute, outer margin slightly excavated to vein 2, and there obtusely angulated; primaries strigate, no prominent maculation.
 Group *Ertincta*.
 Primaries trigonate or obtuse, apex not acute, not subfalcate below 5
5. Median vein obscured by a dusky shade, marked by a white spot at its end.
 Group *Subpunctata*.
 Median vein white or at least concolorous, and not obscured by a dusky shade. 6
6. Rather slight, small species, vestiture with a scaly admixture; a dark shade extends through the center of the primaries from base to outer margin....Group *Ligata*.
 Robust, stout species, vestiture hair or flattened hair; no dark shade extending continuously from base to outer margin 7
7. Primaries obtuse, broader, very much rayed or streaky; median vein white, not obviously margined by a darker shade; no black discal dot; transverse posterior line always completeGroup *Insueta*.
 Primaries narrower, more trigonate, with marked apex; streaking not contrasting and tends to disappear; median vein, if white, marked by an accompanying dusky shade below it; if maculate at all, discal black dot is present; transverse posterior line rarely complete and tends to disappear altogether.
 Group *Phragmatidicola*.

LEUCANIA LUTINA, new name.

Leucania velutina SMITH, Proc. U. S. Nat. Mus., XXII, 1900, p. 480.

Ground color reddish luteous, washed with red brown, especially beyond the middle of primaries. Thorax with a narrow, sharp crest; disk carneau. Palpi reddish gray above, deep velvety brown at the sides. Abdomen washed with carmine red. Primaries with an irregular, diffuse, purplish shade along the submedian vein. Basal line vaguely indicated. Transverse anterior line narrow, single, yellowish, a little oblique outwardly to the middle, and then with a small angle a little oblique inwardly. Transverse posterior line forming an acute angle just below the costa, then evenly oblique to the hind margin; narrow, pale, margined on each side by darker red brown. Subterminal line narrow, yellowish, irregular, preceded by a few small, obscure dark spots, the terminal space a little paler than the rest of the wing. Fringes rust red. A vague dusky median shade line is marked below the cell. Orbicular moderate in size, a little irregular, annulate with yellow. Reniform of good size, oblique, oblong, sides outlined in yellow, upper and lower margins obscure. Secondaries semitransparent at base, blackish outwardly, with carmine interlined fringes and a carmine wash on the disk. Under side

of body velvety dark brown. Primaries brown with a carmine wash, with a blackish discal spot and a blackish outer line. Secondaries with a carmine powdering along costal margin, apex, and half of outer margin; with a broken, dusky outer line and a narrow discal spot.

Expanse.—1.56 inches (39 mm.).

Habitat.—Biscayne Bay, Florida (Mrs. Slosson).

The species has the wing form of *unipuncta* and its general build. The markings are all very narrow, thread-like, perfectly distinct, and yet not contrasting. In color and general appearance it is entirely unlike any of our described forms, though like some of the southern species, from which it seems to be also sufficiently distinct.

The type and only specimen is a female, lacking antennæ, but otherwise in good condition.

I find that Guenée has used the name *velutina* in this genus, and am under the necessity of making a change. I have made as small a one as possible.

LEUCANIA UNIPUNCTA Haworth.

Noctui unipuncta HAWORTH, Lep. Britt., II, 1810, p. 177.

Leucania unipuncta FLINT, in Harris Inj. Ins., 1862, p. 627, figs. 274, 275, 276.—

GROTE, Proc. Ent. Soc. Phila., III, 1864, p. 540.—RILEY, 2d Rept. Ins. Mo., 1870, p. 37, figs. 11, 14-16; 3d Rept. U. S. Ent. Comm., 1883, pp. 89-156.

Leucania extranea GUENÉE, Spec. Gen., Noct., I, 1852, p. 77.—WALKER, C. B., Mus., Het., IX, 1856, p. 93.—GROTE and ROBINSON, Trans. Am. Ent. Soc., II, 1869, p. 77, pr. syn.

Ground color of head, thorax, and primaries a reddish fawn gray, varying toward gray, luteous, and clearer red brown. Palpi a little darker at sides and head often a little darker in front. Collar with a pale, surmounted by a darker transverse, line. Thorax concolorous. Primaries more or less irrorate with dark or blackish scales, which increase in number and tend to darken the outer parts of the wing. Transverse anterior line not traceable or indicated by venular points. A dark point indicates the claviform. Transverse posterior line well removed outwardly, punctiform, variably evident, sometimes scarcely traceable, sometimes geminate, never very prominent. Both ordinary spots are marked as lighter shadings, but are not outlined. Orbicular oval, decumbent. Reniform irregular, marked inferiorly by a white dot at the end of the median vein, which is dusky shaded. A blackish oblique shade line extends from the transverse posterior line on vein 5 to the outer margin at the apex. Fringes short, concolorous. Secondaries smoky brown, tending to become whitish or partly translucent toward base; veins marked and discal lunule evident in the paler examples; fringes whitish or yellowish, somewhat contrasting. Beneath whitish, powdery, primaries with disk smoky and with a smoky costal spot toward apex. Secondaries with costal and outer margins powdery, darker, and with a small black discal lunule.

Expanse.—1.40 to 1.75 inches (35 to 44 mm).

Habitat.—Canada to Florida, to Texas, to the Rocky Mountains; New Mexico; Fort Collins, Colorado; Cartwright, Manitoba.

This is the most common of the species and the most widely distributed. It extends into Mexico and South America, and in our own country is of economic importance. The larva is the Army worm, and the literature is extensive. In the third Report of the Entomological Commission, above cited, the bibliography is fully given to its date. Since then it has been written about in almost every State in which it occurs.

The structural characters of the species are elsewhere referred to, and it remains only to be said that the actual range of variation is not great—chiefly a matter of lighter or darker.

The species occurs throughout the year, but becomes most abundant in September, when it often drives off every other species from sugar.

LEUCANIA PSEUDARGYRIA Guenée.

Leucania pseudargyria GUENÉE, Spec. Gen., Noct., I, 1852, p. 74.—CAULFIELD, Can. Ent., VI, 1874, p. 132, larva.—SPEYER, Stett. Ent. Zeit., XXXVI, 1875, p. 113.—FRENCH, Can. Ent., XIII, 1881, p. 24, larva.

Mythimna pseudargyria WALKER, C. B., Mus., Het., IX, 1856, p. 77.

Leucania pseudargyria, var. *calida* GROTE, New List, 1882, p. 30, note.

Ground color grayish luteous, tending to reddish. Head sometimes rusty brown in front and occasionally the inferior half of the collar is also rusty; but usually it is concolorous. The little tuft behind the collar is sometimes rusty, but more usually concolorous. Primaries very finely speckled with smoky, blackish, or reddish. Transverse anterior line often reduced to black points on the veins or black lunules in the interspaces; when best defined the venular dots are obvious and the outcurves in the interspaces are wide. Transverse posterior line is usually a very even series of venular dots, almost rigidly parallel with the outer margin; sometimes the line is geminate and an inner line of dots parallels that already mentioned; but this inner line is rarely complete and tends to become irregular. There is a series of small terminal dots in the interspaces. The ordinary spots are both obvious, paler than the rest of the wing, not outlined. Orbicular round or nearly so, varying in size. Reniform moderate or rather small, vague kidney shaped with a small black dot at the end of the cell. The terminal area is slightly darker in most examples. Secondaries from pale smoky to black, the fringes lighter, else nearly uniform. Beneath obscure smoky, yellowish, the primaries darker on the disk, with a blackish costal spot from which a punctiform line sometimes crosses the wing. Secondaries paler; sometimes immaculate, sometimes with a discal dot, and sometimes with a series of venular dots forming an exterior line.

Expanse.—1.30 to 1.85 inches (33–46 mm.).

Habitat.—Canada, July and August; New Hampshire, July; New Jersey, April, May, June, July; New York, May to August; Cleveland, Ohio, in June; Glenwood Springs, Colorado, in April.

As a whole this common species occurs east of the Rocky Mountains and does not seem to extend into the Southern States. The sexual structures have been sufficiently noted elsewhere. The males are uniformly larger than the females and sometimes the disproportion is very striking.

Besides this variation in size there is a difference in color, the tendency being to a reddish tint. The distinctly red form Mr. Grote named *callida*, and comparing it with Guenée's *obusta* in the British Museum, I concluded that the two were identical. The species was described as from America, and Walker credits it to the United States, from Doubleday. Mr. Grote, in 1882, referred it somewhat doubtfully as a synonym of *pseudargyria*, and I saw no reason to differ with him. Now Sir George Hampson declares that Guenée's species is from Tasmania; hence should not be associated with the American form. I therefore restore Mr. Grote's term *callida* to indicate the red form of *pseudargyria*.

LEUCANIA PILIPALPIS Grote.

Heliophila pilipalpis GROTE, Proc. Bost. Soc. Nat. Hist., XVIII, 1875, p. 415.

"A male specimen having the facies and ornamentation of *pseudargyria* Guen., but without the exaggerated tufting of abdomen and tibiae. Stout, with hairy eyes and smooth front, and with a curious fan-shaped tuft of spreading hair arising from the upper surface of the second joint of the unusually prominent palpi. Head, thorax, and anterior wings concolorous, fawn gray, like pale specimens of its ally. Forewings sparsely speckled with black. Median lines fragmentary, composed of black marks; transverse anterior line outwardly oblique, subobsolete. Cell shaded with black. Orbicular spot wanting. Reniform, narrow, pale, S-shaped, intersecting inferiorly the black discal shade. Transverse posterior line formed of double dots, connected as in *pseudargyria*, but the line is more oblique and inwardly removed. Fringes pinkish, as is the internal margin, the latter showing an accumulation of the black irrorations. Hind wings whitish, with a smoky clouding outwardly above vein 2. Beneath whitish, without markings, with the fringes on fore wings pink, and the black transverse line visible on costa."

Expanse.—1.72 inches (43 mm.).

Habitat.—Appalachicola, Florida (Thaxter).

Since seeing the original type of this species I have seen only one other example of this species, a female, which, through the courtesy of Mr. Schaus, is now before me. It is in poor condition, but undoubtedly this species. Compared with the description of the male, the transverse anterior line is less obvious and the reniform is not S-shaped. Otherwise the agreement is close.

The palpi in the female are unusually long and slender for a member of this genus, are closely clothed, and without special modification.

LEUCANIA SUBPUNCTATA Harvey.

Heliophila subpunctata HARVEY, Bull. Buff. Soc. Nat. Sci., III, 1875, p. 8.

Leucania subpunctata SMITH, Bull. 44, U. S. Nat. Mus., 1893, p. 189.

Leucania complicata STRECKER, Lep. Rhop. and Het., Suppl., I, 1898, p. 9.

Color a dull, grayish red-brown over a yellowish base. Head with two darker transverse lines on front. Collar with three lighter and three smoky lines alternating. The palagiae are much powdered with blackish. Primaries with a dark smoky or blackish shade over the median vein, relieving a white dot at its end and extending beyond it nearly to the transverse posterior line. In the costal region the veins are whitish, the interspaces streaked with blackish. Along the inner margin is a paler, more yellowish area in which the streakings are lighter. The terminal area is dark, limited above by a somewhat yellowish oblique subapical shade. Transverse posterior line punctiform, complete. Secondaries white, somewhat translucent, veins and outer border smoky. Beneath, primaries smoky with a reddish tinge; a black spot on costa toward apex from which a smoky line may extend across the wing. Secondaries whitish, with the costal and outer margins more or less obviously reddish gray, powdery.

Expanse.—1.35 to 1.52 inches (34 to 38 mm.).

Habitat.—Agricultural College, Mississippi, in October; Harris County and elsewhere in Texas in March; New Mexico, near its southern border.

This seems to be locally common in Texas; but it was many years before I had an example in my collection. At present I have eleven specimens, representing both sexes, and except for size and for a little lighter or a little darker general effect there is no variation.

The structural features and other distinctive characters are elsewhere referred to.

Complicata Strecker was described from a rather small New Mexican specimen before the species had turned up in large numbers in Texas.

LEUCANIA LUTEOPALLENS, new species.

Leucania pallens SPEYER, Stett. Ent. Zeit., XXXVI, 1875, p. 112, and of American authors generally.

Ground color a creamy yellow, the primaries with the veins paler, the interspaces with somewhat more luteous streakings. Head, collar, and thorax immaculate. The median vein and its lower branches at the end of the cell tend to paler, and a slightly darker shade is usually noticeable below the median. A black discal dot at the end of the cell. Transverse posterior line reduced to two black dots. Secondaries white, the veins on disk and a small area of the disk itself tinged with blackish. Beneath yellowish white; primaries with a blackish streaking at the end of the cell and an outer dusky venular band; secondaries

with a tendency to a dotted outer line, which is rarely complete and may be entirely wanting.

Expanse.—1.20 to 1.36 inches (30 to 34 mm.).

Habitat.—Canada to Florida; Elizabeth, New Jersey, May and June; Anglesea, New Jersey, in April; Archer, Florida, in March.

Twenty or more examples are before me from almost every North and Middle Atlantic State, but only on a few are there dates of capture.

The sexual and other distinctive characters have been already pointed out, and the range of variation is not great. There is a little difference in depth of ground color, in the relative distinctness of the strigation, and in the amount of black on the disk of the secondaries; otherwise the specimens run very even.

It is probable that the species extends to the Mississippi Valley, and perhaps to the elevated plains beyond.

Type.—No. 6244, U.S.N.M.

LEUCANIA MINORATA Smith.

Leucania minorata SMITH, Trans. Am. Ent. Soc., XXI, 1894, p. 75, pl. v, fig. 11.

Ground color grayish luteous, head and collar sometimes obscurely darker, immaculate. Primaries quite obviously strigate, the veins paler, the interspaces with one or two or three decidedly darker strigæ in the interspaces. There is always an obvious though not contrasting shade beneath the median vein, usually a smoky, curved shade on the inner margin near base, and quite frequently a decidedly blackish line between veins 5 and 6. A black dot at the end of the discal vein. Two black dots represent the remnants of the transverse posterior line. There is a series of minute black terminal dots, which may be obsolete. Secondaries with disk smoky, the margins whitish. Beneath, primaries with a larger or smaller part of the disk smoky, a more obviously blackish shading at the end of the cell. Sometimes with an indicated punctiform outer line. Secondaries white with a small black discal dot.

Expanse.—1.20 to 1.35 inches (30 to 34 mm.).

Habitat.—San Francisco, California; Corvallis, Oregon, May 20, June 12, August 24, September 17; Corfield and Livingston, Vancouver, throughout July to August 12; Calgary, Alberta, June 24 to July 30.

Eighteen examples are under examination. The term *minorata* is a misnomer, if this species is to be compared with *luteopallens*, but I considered it nearer to *oxygale* in the original description. As a matter of fact, it stands between *oxygale* and the European *pallens*, being really the American representative of the latter species.

The range of variation, except in size, is small. It is a matter of little more contrast on the primaries between the lighter and darker streakings; a little more or a little less blackish on the secondaries.

On the under side the range of variation is greater, no two examples being quite alike in the amount of black on primaries. In this point also the species agrees well with *pallens* rather than *luteopullens*.

LEUCANIA OXYGALE Grote.

'*Heliophila oxygale* GROTE, Can. Ent., XIII, 1881, p. 14.

Leucania oxygale SMITH, Bull. 44, U. S. Nat. Mus., 1893, p. 185.

Ground color a very pale creamy, overlaid with gray, giving the impression of a pale luteous gray or dirty pale clay yellow. Head and thorax immaculate. Primaries with the veins paler and the usual dark strigations in the interspaces, but so little contrasting that the wings seem almost immaculate. The median vein is only a little paler and the dot at the end of the cell is very small or altogether wanting. So the transverse posterior line consists at most of two black venular points, and may be altogether wanting. Secondaries either uniformly smoky, or the margins may be paler and the veins darker; always with a large area of the disk blackish. Beneath, white, more or less black powdered or with smoky suffusion. The primaries may be blackish, except at the margins, and they may be black shaded only over the discal area at the end of the cell. Secondaries usually with only a light powdering of blackish scales, a small black discal dot, and a narrow, yellowish-tinted marginal area; rarely a large part of the discal area is blackish.

Expanse.—1.25 to 1.40 inches (31 to 35 mm.).

Habitat.—Alameda County, California, in June (Koebele); Los Angeles, California, May 15 (Smith); Palo Alto, California, April 30, Middle California (Barnes); Sierra Nevada, California (Hy. Edwards); Beulah, New Mexico, July 14, 18 (Cockerell); Salt Lake Utah (Hy. Edwards); Denver and Glenwood Springs, July 1 to 7, Colorado (Barnes).

Fourteen examples are under examination. It is the least contrasting of the species in this group, and the least variable in consequence. The black dots on the primary are never very strongly marked, but any one or all of them may be absent. Some specimens have quite a clear creamy-yellow tint, but the majority has a dirty gray addition that dulls the color.

While the range in size brings this species only a little above *minorata*, yet, as a matter of fact, most of the specimens exceed 1.30 inches and nearly or quite reach 1.35 inches, while in *minorata* the smaller number reach 1.30 inches, and very few indeed exceed it.

LEUCANIA RUBRIPALLENS, new species.

Ground color dull reddish luteous. Head and thorax immaculate. Primaries with the streakings well marked, though not much contrasting; median vein usually relieved by a darker shade beneath it. Discal black dot very small or entirely absent. The two dots indicating

the transverse posterior line are usually traceable, never prominent, and often entirely absent. Secondaries yellowish in tinge, ranging to a transparent smoky, the disk being always a little darker. Beneath much paler than above; primaries with the disk variably blackish, ranging from a little shading over the cell to nearly the entire surface. Secondaries more or less powdery along the costa, and a little on the outer margin, with a small discal dot on a majority of the specimens before me.

Expanse.—1.25 to 1.40 inches (31 to 35 mm.).

Habitat.—Sierra Nevada, California (Hy. Edwards); Salt Lake, Utah (Hy. Edwards); Utah in July (Poling); Denver, Colorado, June 10 (Osler); Glenwood Springs, Colorado, June 24, July 10, 16, and August 24 (Barnes).

Eleven examples are before me, and they vary little except in the depth of the red tinge and in the amount of black on the secondaries. On the underside there is the usual range of variation as to area covered by black shadings and powderings, but nothing else.

The average size of the specimens is 1.30 inches, three examples—females—exceeding that materially, while only two fall much below it.

Type.—No. 6246, U.S.N.M.

LEUCANIA PERTRACTA Morrison.

Heliophila pertracta MORRISON, Proc. Bost. Soc. Nat. Hist., XVIII, 1875, p. 120.

Leucania pertracta SMITH, Bull. 44, U. S. Nat. Mus., 1893, p. 186.

“Eyes hairy. Head and thorax concolorous with the anterior wings. The latter are uniform yellowish salmon color, interrupted only by the median vein, which is white, as well as its second and third branches; the apical costal branches are also whitish. Posterior wings and under surface white, immaculate.”

Expanse.—34 mm. Length of body, 16 mm.

Habitat.—Philadelphia, Pennsylvania.

I have already recorded my convictions as to this species; but give the above copy of the original description, since, after all, the insect may be American, though not, I am convinced, a native of Pennsylvania.

It is obviously a member of this group and quite out of the range of variation for *luteopallens*. The primaries are like *rubripallens*, but the white secondaries and underside bar it. If the same form does ever again turn up, there will be no difficulty in recognizing it.

LEUCANIA RUBRIPENNIS Grote and Robinson.

Leucania rubripennis GROTE and ROBINSON, Trans. Am. Ent. Soc., III, 1870, p. 179, pl. II, fig. 77.

Ground color a creamy, varying to pale lemon yellow, shaded with pinkish carmine, varying in depth. The carmine shading on primaries begins on the costal region before the middle, is very slight to apical

third, broadens there, but narrows again so as to leave the apex clear. Below the median vein, which is paler and may be white, the carmine fills half the submedian interspace to vein 2, and all the space between veins 2 and 3. Veins 3 and 4 are pale, and the space between them is usually more or less completely pale; but it may be entirely reddish. Above vein 4 a carmine shade begins at the end of the cell as a point and broadens out so as to reach the outer margin below the apex. No black points or dots on any of the specimens before me. Secondaries white, sometimes with the margins a little soiled. Beneath white, primaries with a pinkish or yellowish shade. Head with a rusty yellow shading in front and sometimes with a rusty line above the antennæ. Collar of the palest ground color inferiorly, rusty above and on the disk behind the collar. The front of the breast is also rusty or reddish.

Expanse.—1.34 to 1.50 inches (34 to 38 mm.).

Habitat.—Texas in August; Kansas City, Missouri, in August (Hall).

Six examples are under examination, and I have seen others. The species must be locally and seasonally common, for Belfrage seemed to have taken it in numbers; but since his time very few examples have found their way into collections. In 1898 Mr. F. J. Hall, by taking the species near Kansas City, Missouri, extended its known distribution materially; but I have no data as to how frequently it is captured there.

There is little observed variation, and the insect is altogether so well marked that no difficulty will be found in identifying it.

LEUCANIA ALBILINEA Hübner.

- Leucania albilinea* HÜBNER, Zutraege, Ex. Schmiett, 1816, p. 25, No. 169, figs. 337, 338; Verzeichniss, 1816, p. 241.—GUENÉE, Spec. Gen., Noct., I, 1852, p. 89.—WALKER, C. R., Mus., Het., IX, 1856, p. 99.—RILEY, 9th Rept. Ins. Mo., 1877, p. 50, figs. 14, 15, all stages.—GROTE, Can. Ent., XII, 1880, p. 116.
Leucania harveyi GROTE, Bull. Buff. Soc. Nat. Sci., I, 1873, p. 9, pl. 1, fig. 14.—HARVEY, Bull. Buff. Soc. Nat. Sci., III, 1876, p. 8.—GROTE, Can. Ent., XII, 1880, p. 116, as sp. dist.—SMITH, Bull. 44, U. S. Nat. Mus., 1893, p. 186, pr. syn.

Ground color a dirty luteous, more or less smoky, varying in depth. The head tends to become rusty yellow in front. Collar whitish inferiorly, the paler shade crossed by a narrow brown line. A black or brown line surmounts the whitish area and shades into the ground color at tip. Patagiæ with a more or less obvious white line and the disk behind the collar a little white. Primaries with the brightest pale color extending from base through the cell to the apex. A similar, more irregular area of bright shade extends along the inner margin. Costal area from base nearly to apex gray, or brown streaked, not contrasting, but in contrast to the even lighter shade below it. Median vein white or at least pale, the light shade continued on veins 3 and 4 to the margin; not unusually the interspace between these veins is paler than the area above or below. A brown shading below

the median vein extends at least to its end and usually to the outer margin; often the vein is inferiorly edged with black. A black narrow line extends from base into the submedian interspace and forms a loop near the middle of the wing, suggesting a claviform. Above vein 4 there is a triangular dusky area which, on the outer margin, reaches almost to the apex. The terminal space may be leaden gray or concolorous, or there may be a series of black marks indicating the subterminal line. There may be a small or a large black discal dot or none at all. It may break up into two of equal or unequal size or even into three, and these indicate the reniform. Fringes usually darker, with a pale line at base. Secondaries smoky brown or blackish, even or only a little paler at the base; fringes white. Beneath, powdery gray over dirty white, the secondaries paler; the dark shading variable, forming no obvious markings.

Expanse.—1.12 to 1.32 inches (28 to 33 mm.).

Habitat.—Anglesea, New Jersey, June 10, September 3; Cleveland, Ohio, May 5, 9 (Kearfott); Glenwood Springs, Colorado, June 5 (Barnes); southern Arizona (Barnes).

The above are specific localities referring to the fourteen examples now before me. It is probable that the species occurs throughout the Eastern United States and extends into Canada. It is not impossible that the south Arizona example may represent a good species. The single specimen is only enough to create a doubt. The majority of specimens expand about 1.20 inches.

I have carefully compared Hübner's figure and have matched it perfectly in the series before me. I have little doubt that it is this species really, though the type was said to come from Buenos Ayres. Hübner's description does not help much; he says it is a *noctua genuina* and *Heliophila pallida*. To *Leucania l-album* it is rather similar, but has an entirely unique middle marking besides other variations.

On the other hand there is no doubt but that Mr. Grote intended the form here treated when he described his *hurveyi*. The description fits it perfectly and fits no other.

The range of variation has been partially indicated in the description; it is not really great and yet there is enough to make quite a little difference in appearance. In the one extreme there are no black streaking and no discal dots; in the other there is black everywhere, below the cell, even in the cell; the discal spot breaks up and in every interspace along the subterminal line is a black mark or streak.

The species has a large economic bibliography which is not here referred to. The larva is known as the wheat-head army worm.

LEUCANIA OBSCURIOR, new species.

Resembles *albilinea* in general type of maculation, but is somewhat darker on the whole, with less contrast, the ornamentation much more even. The median vein is white, the shading below it does not usually

differ very greatly from that along the inner margin; but on the other hand there is a shading above the vein, continuous with the trigonate shading above vein 4. In only one example is a discal dot observable. Secondaries white at base with a smoky tinge outwardly. Beneath whitish, with a distinct yellow tinge over the costal region.

Expanse.—1.20 inches (30 mm.).

Habitat.—Cartwright, Manitoba (Heath).

Two males and two females only, all very much alike and all more or less imperfect. The material is scant to authorize a new species in this group; but the combination of dark primaries, like those in *albilinea* with pale secondaries, leads to the belief that with more material additional points of difference will be brought out. Meanwhile it is at least a well-marked local form.

Type.—No. 6246, U.S.N.M.

LEUCANIA DIFFUSA Walker.

Leucania diffusa WALKER, C. B., Mus., Het. IX, 1856, p. 94.—Druce, Biol. Cent. Am., Het., I, 1889, p. 262, pl. xxvi, fig. 10.

Leucania albilinea GROTE, Ill. Essay, 1882, p. 42.—SMITH, Bull. 44, U. S. Nat. Mus., 1893, p. 186.

Leucania moderata WALKER, C. B., Mus., Het., IX, 1856, p. 114.—SMITH, Bull. 44, U. S. Nat. Mus., 1896, p. 186, pr. syn.

Ground color a very pale luteous, tending to whitish. Head with a more or less obvious rusty tinge. Pale portion of collar with a brown or blackish transverse line, the tip rusty over a black line. Patagiae with a white line on disk and on the thorax a white line behind the collar. Primaries as a whole have the region along the inner margin broadly pale; in the male the costal region is usually as light; in the female it is gray with a pinkish tinge. A loop-like claviform is more or less completely indicated in every specimen, and is attached to a narrow black basal streak. The white median vein is usually black margined beneath, and below this is a gray or brown shading. A black discal spot is present in all the specimens, and often there are two. The terminal space is usually gray or brown, and the usual triangular shading above vein 4 is well marked, though not so broad as in *albilinea*. The fringes are of the pale ground and usually have a still paler line at base. Secondaries white, becoming smoky at the outer margin, varying in this particular. Beneath white, more or less powdery; primaries with the costa broadly yellowish or creamy, the disk tending to blackish.

Expanse.—1.15 to 1.38 inches (29 to 35 mm.).

Habitat.—Nova Scotia (Walker); New Hampshire; Newton, Massachusetts; Torrington, Connecticut; Newark, May 5, August 17, and Montclair, New Jersey, August 4 (Kearfott); Anglesea, New Jersey, August 21 (J. B. S.); Iowa City, Iowa, July 29 (Wickham); Mesilla

Park, New Mexico, April 4 (Cockerell); Shovel Mountain, Texas (Barnes); City of Mexico (Druce).

Specimens from all save the first and last of the above-cited localities are at hand, with a few others that have State labels only. The range extends, therefore, from the boreal area to the Tropics, though probably not to the real tropical fauna.

In the comments on *albilinea* I referred to the fact that a large economic literature exists for that species. It is not improbable that in great part the species now under consideration is really intended, hence citations must be cautiously made. It is also highly desirable that systematic breeding be done to discover the range of variation and what, if any, differences are discoverable in the larva.

L. moderata Walker, was described from "locality unknown;" but the type in the British Museum seemed to me American and like *diffusa*; so the reference was made.

The range of variation is very like that in *albilinea*, but not so great in contrast. In every respect the insect looks and is paler. When once the attempt is made to separate out, there is no difficulty in arranging the series.

LEUCANIA LIMITATA, new species.

Very pale creamy yellow. Head a little rusty in front. Collar gray rather than white inferiorly, limited by a white, surmounted by a black line. Primaries without costal darker shading. Median vein white, margined above by a smoky brown line which beyond the cell enlarges into the usual trigonate shading. Below the median vein is a narrow yellow brown shade, the vein itself black edged near the end. A small black basal streak with a very narrow loop-like claviform. Terminal space a little darker. Secondaries white, immaculate. Beneath white or a very little yellowish, the costal region a little darker.

Expanse.—1.32 inches (33 mm.).

Habitat.—Texas, in June (Hulst coll.).

Only a single male in fair condition. It is unfortunate that no greater material of this species should be available to bring out more clearly what differences exist.

LEUCANIA TETERA, new species.

Ground color a pale creamy yellow. Head dull luteous. The white portion of collar crossed by a narrow luteous line; no defining line between the pale lower and darker upper portion. Thorax dull luteous. On the primaries the costal region becomes shaded with pink toward the apex. A small black discal dot. The usual dusky shade above vein 4, but interrupted by two white, black-edged dotlets in the interspaces, marking the subterminal line. Median vein concolorous

until near its tip, then whitish and opening into the 3-4 interspace. Below the median vein is a dusky shading, blackish at base and end of median vein, gray and reddish luteous beyond and below. The claviform barely traceable. Terminal space leaden gray except at apex. Subterminal line marked by black scales or by paler, black-margined points. A small black discal dot. Fringes white, with a yellow line at base and two narrow blackish interlines. Secondaries white, pearly, semitransparent. Beneath, primaries pale creamy, tending to pinkish along the costa; secondaries pearly white, tending to creamy along the costa.

Expanse.—1.16 to 1.28 inches (29 to 32 mm.).

Habitat.—Wilgus, Cochise County, and southern Arizona (Barnes).

Three male examples, two of them in fair condition. They are very much alike and there is no doubt as to the distinctness of the species. The genitalic differences have been already referred to, as have the superficial color characters. The anterior femur has larger tufts than usual in this group and the fore tibia is also well tufted. On the middle and hind legs the tuftings, while well developed, are not especially prominent.

Type.—No. 6247, U.S.N.M.

LEUCANIA NEPTIS, new species.

Ground color a dull, lifeless, very pale yellow; the dark shadings on the primaries are an equally lifeless yellow or smoky brown. Head tending to rusty brown. Thorax dull luteous; a white line separating the pale from the dark portion of the collar. Primaries with all save internal and median veins dusky; breaking up what in other species is the clear sweep of the paler shade to the apex. The usual trigonate shade above vein 4. The dusky shade below the median shade merges gradually into the paler ground. A small black basal dash; but in few instances can the claviform be traced. Terminal space dusky. Discal dot absent or reduced to a mere point. Fringes whitish with two dusky interlines. Secondaries white with a faint yellowish tint. Beneath very pale yellowish; primaries deeper tinted and more yellowish along the costal region.

Expanse.—1.20 to 1.40 inches (30 to 35 mm.).

Habitat.—Colorado (Neumoegen); Fort Collins, Colorado, August 15 (Kearfott).

Nine examples are before me, eight of them from badly papered specimens. One perfect example from the Neumoegen collection.

There is an indescribable lifeless shade to all these examples, giving no contrast, no defined impression—all one dull sameness.

The leg tuftings in the male are better developed than in other species of the group save *isera*. In *neptis* the anterior leg is not especially more prominent than the others.

I have little doubt as to the specific standing of this form.

Type.—No. 6248, U.S.N.M.

LEUCANIA LIGATA Grote.

Heliophila ligata GROTE, Trans. Am. Ent. Soc., V, 1875, p. 115.

Leucania ligata STRECKER, Rept. Chief Eng., 1878-79, V, 1879, p. 1862.

This slender species has pure white secondaries and fringes in the female, while in the opposite sex these are slightly soiled. Forewings whitish ocher gray, faintly purple tinged, with the veins obsoletely white marked and accompanied by longitudinal blackish shades. Median nervure covered by a whitish streak, culminating in a white spot relieving a single inferior black dot and accompanied by a black shading which continues diffusedly to external margin, and leaves a clear ochery space above it on the cell, reaching beyond the dotted transverse line. Transverse posterior line indicated by a series of black venular points. Very minute marginal black points; fringes a little paler than the wing. Thorax and head like primaries. Beneath, without discal dots or common lines; a terminal dotted line on both wings; primaries and costal region of secondaries somewhat rosy gray, else the secondaries are whitish, subpellucid. Under surface of body and legs of a slightly rosy gray. Collar faintly lined.

Expanse.—1.10 to 1.22 inches (27.5 to 30.5 mm.).

Habitat.—Texas, March to November; Florida in March; Colorado, July 31.

Twelve examples are before me, mostly from Texas; Shovel Mountain and Harris County being the only specific localities. The above is practically Mr. Grote's description, not in quotation marks, because not literally transcribed.

In general, there is a decided reddish gray tinge, a coarse black powdering, an obvious dotted transverse posterior line, and a longitudinal dark streak which extends over the white marked median vein from base, beyond it to the transverse posterior line or even the outer margin. The secondaries are rarely immaculate, but may be so in either sex; nor, on the other hand, is the smoky outer margin very extensive, in any case seen by me. The species does not seem to be rare in Texas and tends to lose the reddish or purplish tinge.

LEUCANIA FLABILIS Grote.

Heliophila flabilis GROTE, Can. Ent., XIII, 1881, p. 15.

Leucania flabilis SMITH, Bull. 44, U. S. Nat. Mus., 1893, p. 189.

Very pale ochery or straw color, shaded with fuscous. The pale longitudinal shades extend along the cell over the interspaces between veins 5 and 6, nearly to the margin. A short pale shade on the interspace above and extending nearer the margin. From the base a wide

submedial shade extends outwardly to the margin. A black dot marks the reniform at median vein; an extra-mesial row of dots on the nervules, not prominent. The veins are indistinctly paler. The darkest portion of the wing is along the median vein, and a fine black streak runs along the interspace between veins 4 and 5. Hind wings whitish, vaguely soiled with fuscous exteriorly. Thorax concolorous with primaries; no lines on the collar. Beneath without marks. This species recalls in maculation *lapidaria*, but is more diffusely shaded, the spots of the outer line more numerous, the hind wings darker, the body more slender.

Expanse.—1.32 inches (33 mm.).

Habitat.—Long Island, near the seashore, in May.

The species was taken by Mr. Fred. Tepper who had a cotype, and this is the only example of *flabilis* known to me in any American collection. It is probable that the insect is very local and that may account for its absence in cabinets. I have already stated that I can see no difference between *ligata* and *flabilis* except that the latter lacks the purplish shading. But the Tepper specimen has a purplish tinge, and I have a Texas example that has as little. An expanse of 33 mm. is too great for the cotype and too great for any *ligata* known to me.

The description is essentially that originally given by Mr. Grote.

LEUCANIA RIMOSA Grote.

Heliophila rimosa GROTE, Can. Ent., XIV, 1882, p. 216.

— *Leucania rimosa* SMITH, Bull. 44, U. S. Nat. Mus., 1893, p. 189.

Fore wings hoary gray, something like *ligata* in color; irrorate with dark speckles and with a faint warm shade, reminding one a little of *unipuncta* in these respects. Allied to *commoides*; no lines or spots visible except that there is continuous series of excessively minute subterminal dots, and the median vein is faintly marked with white and edged with black; the white color accentuated at base of third and fourth median nervules. Hind wings pale gray, whitish, veins soiled. Beneath a blackish shade marks the inception of the subterminal line on costa, and the median vein is shaded at base of nervules. Hind wings with costa darker; no lines or spots. Face and pectus a little smoky; fore tibiae pale outwardly. Thorax gray; abdomen paler.

Expanse.—1.36 inches (34 mm.).

Habitat.—Kittery Point, Maine.

No one has taken this species save Dr. Thaxter, so far as I am aware, and the original type is with him. A second specimen which he kindly sent me is smaller—only 31 mm.—and the longitudinal shading through the center of the wing is quite obvious though not conspicuous. I can find nothing to suggest *commoides*.

LEUCANIA DIA Grote.

Heliophila dia GROTE, Can. Ent., XI, 1879, p. 29; Ill. Essay, 1882, p. 56, pl. II, fig. 19.

Leucania dia SMITH, Bull. 44, U. S. Nat. Mus., 1893, p. 187.

Ground color a pale reddish gray. Head and fore breast smoky tinged. Collar with a somewhat darker line across the middle. Thorax concolorous. Primaries without strong contrasts. Veins white-marked or at least paler, the costal region gray or whitish. Interspaceal rays not prominent or contrasting. Transverse posterior line punctiform. A series of very small terminal, interspaceal dots which may be wanting. A narrow pale line at the base of the fringes. Secondaries dirty whitish, almost uniform, veins a little darker. Beneath, primaries pale reddish gray, costal region whitish to a dusky blotch about one-fourth from apex. Secondaries whitish, powdery, a little darker and more powdery over the costal area.

Expanse.—1.16 to 1.24 inches (29 to 31 mm.).

Habitat.—California; Oregon.

Three males and one female are before me. One of these agrees perfectly with Mr. Grote's description. The second is more reddish and a little larger and agrees better with the picture in the "Illustrated Essay." The others, from "Middle California," are somewhat darker and have the interspaceal streaking much better marked. The character emphasized by Mr. Grote in his description, i. e., the absence of a dusky shading along the median vein, loses force here, because, while it is by no means prominent, there is undoubtedly a smoky line on each side of the vein. The triangular dusky shading in the terminal area of the wing is also well indicated here.

The heavily clothed quadrate thorax, as against the short, obtuse wings, gives the insect a peculiarly stumpy appearance.

LEUCANIA MEGADIA, new species.

Ground color a dirty reddish gray, tending to smoky. Head varies to rusty or smoky, as does the forebreast. Collar with a blackish central line. Thorax concolorous. Primaries with veins white, interspaceal streaks obvious and tending to become black beyond the transverse posterior line. The latter is punctiform and well marked. Median vein margined by smoky shadings above and below, forming a more conspicuous white dot at its end and usually emphasized there by black scales. A distinct black or blackish basal streak in the submedian interspace. The costal region is usually paler gray. In the terminal area of the wings the dusky shadings are so disposed as to form a more or less obvious dark area over the internal angle and a trigonate shading below the apex. Secondaries smoky yellowish, nearly uniform. Beneath, primaries smoky reddish gray, disk darker

and at outer fourth a variably marked dusky costal spot; secondaries paler, the costal region black powdered.

Expanse.—1.12 to 1.36 inches (28 to 34 mm.).

Habitat.—Calgary, Alberta, June 15 to July 20; Oregon (Koebele); Pullman, Washington, May 25 (Piper); Nevada County, California (Koebele); Yellowstone Park, Wyoming, July 10; Denver, Colorado, June 30; Chiricahua Mountains, Arizona, July 4 (?).

This species has the body less robust and the wings broader than in *dia*, hence it looks decidedly larger, an appearance which was not borne out on actual measurement in all cases. The average runs only 1 or 2 millimeters larger.

Sixteen examples, varying in distinctness; the Calgary specimens are probably all from Mr. Dod, the Yellowstone example is from Dr. Barnes. One example from Calgary is almost as even in color as *dia*, but has the black basal streak obvious. This latter feature will serve to distinguish the two small species in the group without difficulty.

There is a decided tendency to a red shading and one specimen is as red as any *insueta* I have ever seen, the costa in this case being almost white. The single example from the Chiricahua Mountains is a female and in such condition that the reference is not positively made.

Type.—No. 6249, U.S.N.M.

LEUCANIA HETERODOXA Smith.

Leucania heterodoxa SMITH, Trans. Am. Ent. Soc., XXI, 1894, p. 75, pl. v, fig. 7.

Ground color a dirty luteous gray with a varying reddish tinge. The head may be either a little lighter or a little darker than the ground color. The tuftings of the front legs in the male are conspicuously darker. Collar with a dusky or black median line either relieved by paler lines above and below, or with a second, less conspicuous line just below tip. Disk of thorax and patagiæ powdery, the latter tending to a marginal line. Primaries obviously and often conspicuously streaked in the interspaces; the veins white or whitish. Median vein white, forming a white spot at its end, margined by a darker shading. The costal region is paler, sometimes a little contrasting, until just before the apex. The transverse posterior line is a series of black venular dots, evenly curved and nearly parallel with the outer margin. The dark shadings in the wing are above the anal angle and from the transverse posterior line on vein 2 or 3, obliquely to the apex. In some examples there is a costal shade before the apex and in some cases the apex is dusky. There is a series of small terminal black dots. The fringes are dusky and have a pale line at base. Secondaries smoky or fuscous, fringes paler. Beneath powdery, varying in tint. Primaries are from reddish gray to smoky and have a blackish costal spot toward apex. Secondaries are whitish, becoming more powdery and more reddish in the costal region.

Expanse.—1.28 to 1.40 inches (32 to 35 mm.).

Habitat.—Pullman, Washington, May 25, June 10 (Piper); Corvallis, Oregon, May 1 to June 6 (Cordley); Corfield, Vancouver; Nevada County, California (red number 342 Koebele); Denver, Colorado, June 30; Boulder, Colorado, August 10; St. Anthony Park, Minnesota, June 25 (Lugger); Sierra Nevada, California; Laggan, British Columbia, 5,000 feet, July 2.

A long series of examples is before me from all save the last two mentioned of the above localities. It establishes the species and illustrates its range of variation, which is narrow. There is a very slight tendency to a reddish tinge, but nothing to cause confusion with *insueta*, from which this species is also well separated by the absence of a black basal streak. In some examples the indications of such a streak may be made out by close scrutiny, but I have never found a case where there was enough to give any reason for hesitation.

Aside from this it is a mere matter of lighter or darker, or more or less contrast, and this seems to depend somewhat on the age of the specimen.

The sexual and other structural characters have been elsewhere defined.

LEUCANIA INSUETA Guenée.

Leucania insueta GUENÉE, Spec. Gen., Noct., I, 1852, p. 81.—WALKER, C. B., Mus., Het., IX, 1856, p. 95.—SMITH, Bull. 44, U. S. Nat. Mus., 1893, p. 188.

Leucania commoides GROTE, Can. Ent., IX, 1877, p. 28.

Heliophila adonea GROTE, Bull. Buff. Soc. Nat. Sci., II, 1874, p. 159.—SMITH, Bull. 44, U. S. Nat. Mus., 1893, p. 188, pr. syn.

Leucania mimica STRECKER, Lep. Rhop. et. Het., Supp. II, 1899, p. 6.

Ground color a pale reddish luteous. Head a little lighter or a little darker, but always uniform. Collar with a smoky or blackish central line. Thorax more reddish gray, speckled lightly with black. Primaries streaked and shaded with brick red or even darker red brown. Costal region always paler and sometimes white. Veins white, or at least paler. Median vein white, enlarging into a little spot at its end, shaded on each side so as to darken the center of the wing. A short black basal streak in the submedian interspace. A shorter dark brown or blackish streak on the hind margin near base. Transverse posterior line black, punctiform, evenly curved. An oblique brown shade over the anal angle and a second from vein 2 at the transverse posterior line to outer margin below apex. The white veins are often a little expanded at the base of the fringes. Sometimes a series of small terminal black dots, rarely an almost continuous brown line; often neither. Secondaries whitish or yellowish at base, darkening outwardly to smoky or blackish; fringes with a yellow line at base. Beneath, primaries reddish gray, powdery, with a smoky costal dot from which starts a variably complete punctiform extra median line;

secondaries whitish, except in apical and costal region, with a more or less complete, punctiform extra median line.

Expanse.—1.24 to 1.44 inches (31 to 36 mm.).

Habitat.—Nova Scotia; Canada in July; New York, June to August; Newton, Massachusetts; Missouri; Glenwood Springs, Colorado, September 1 (Barnes).

This is a common species, hence my material is not especially good. There are twenty or more specimens, but not well distributed as to locality and few of them dated. It is probable that the species occurs throughout the Eastern United States, but may not extend far southward.

The range of variation is much like that given for *heterodora* and is chiefly a matter of contrast. In some examples the base is quite a clear yellow and on this a deep rich red makes a striking specimen. In others everything is dull, or there is a grayish tinge. This is the only species in which an obvious outer line is usual on the under side.

Mr. Strecker's type is the usual Colorado form, in which the contrasts are not quite so great. Yet he would hardly have made the error had he not placed it at once with *commoides* as the closest ally. From that species it is, of course, easily distinguished.

LEUCANIA EXTINGTA Guenée.

Leucania extincta GUENÉE, Spec. Gen., Noct., I, 1852, p. 79.—WALKER, C. B., Mus., Het., IX, 1856, p. 94.

Leucania linita GUENÉE, Spec. Gen., Noct., I, 1852, p. 81.—WALKER, C. B., Mus., Het., IX, 1856, p. 95.—SMITH, List Lepidoptera, 1891, p. 46, pr. syn.

Leucania scirpicola GUENÉE, Spec. Gen., Noct., I, 1854, p. 84.—WALKER, C. B., Mus., Het., IX, 1856, p. 96.—SMITH, List Lepidoptera, 1891, p. 46, pr. syn.

Heliophila amygdalina HARVEY, Can. Ent., X, 1878, p. 57.—SMITH, Bull. 44, U. S. Nat. Mus., 1893, p. 187, pr. syn.

Ground color a very pale creamy yellow, primaries streaked with blackish and silver gray, tending to a faint reddish. Head with a slight admixture of brown scales in front. Collar with two dark gray transverse lines. Thorax immaculate. Primaries with all the veins narrowly white. A whitish dot marked by black scales at the end of the median. A series of black dots forming the transverse posterior line and this line is abruptly bent inward on vein 4. Secondaries white, semitransparent, with a somewhat yellowish tint. Beneath, primaries a little smoky on disk, and with a blackish costal spot; secondaries a little yellowish and powdery along the costa.

Expanse.—1.30 to 1.44 inches (33 to 36 mm.).

Habitat.—Maine; New York; Florida; Newark, New Jersey, May 12, 16, July 25 (Buchholz, Weidt); Elizabeth, August 4 (Kemp).

Five examples, all of them from Newark and Elizabeth, New Jersey, are before me. The species is not represented in any of the large collections, and yet it has a considerable range. Druce records it from

Mexico and adds *insueta* Guenée and *antica* Walker to the synonymy above given. As to the latter, he may be right; the description being of a South American species did not require me to identify it. As to *insueta* he is surely in error, for I compared the examples in the British Museum, and, in addition, the description does not fit at all. Guenée, who in all the other descriptions mentions the pointed apex of primaries and the very oblique hind angle, expressly states for *insueta* that they are less sharp than in *completa*, with which he compares it. In addition, mention is made of the black basal streak, obvious in *insueta* and absolutely wanting in *extincta*.

With a good example at hand it is simply impossible to mistake the species from its wing form and the gray strigation. But when the insect is a little rubbed, matters are not so easy. The characteristic wing form is destroyed by rubbed fringes; the gray interspacial lines are easily marred and there remains an almost characterless individual. It is in this way that M. Guenée fell in error.

Enough has been said under the group heading to place the species on structural characters.

LEUCANIA JUNCICOLA Guenée.

Leucania juncicola GUENÉE, Spec. Gen., Noct., I, 1852, p. 83.—WALKER, C. B., Mus., Het., IX, 1856, p. 96.

Heliophila adjuta GROTE, Bull. Buff. Soc. Nat. Sci., II, 1874, p. 158; Bull. Buff. Soc. Nat. Sci., III, 1875, p. 8.—SMITH, Bull. 44, U. S. Nat. Mus., 1893, p. 188, pr. syn.

Ground color a rather bright creamy yellow, strigation of the primaries luteous. Head with a frontal and interantennal purplish line. Collar crossed by two dusky lines near the middle, and at the tip a series of four contiguous lines of different colors gives the impression of a reddish or purplish band. The little anterior crest has the same purplish markings. Primaries with the veins whitish; the interspaces with at least two narrow, luteous lines. Median vein a little more broadly pale, inclosing a small black dot at its tip. The transverse posterior line is usually indicated by two venular dots only, but may be complete. A black dot is in the submedian interspace about one-third from base. There are no strongly marked shadings, but it is readily seen that a somewhat darker shade extends below the median to its end, broadens out a little and continues to the outer margin, extending from vein 4 and to the apex. Another shading extends over the subcostal and, broadening out somewhat, reaches the costa before the apex. A series of very small, black terminal dots. Fringes concolorous. Secondaries somewhat pearly white at base, semitransparent, with a smoky outer border and yellowish fringes. Beneath, primaries with an obvious pinkish tinge, the disk tending to blackish. Secondaries with the costa yellowish, powdery, and a series of black terminal spots in the interspaces.

Expanse.—1.30 to 1.45 inches (32 to 36 mm.).

Habitat.—Texas in March; Florida; Alabama.

Eight examples are at hand just now, all very much alike. Except for two examples from San Antonio, they have State labels only, and not one has a date of capture. One female has a marked reddish tinge in the ground and the secondaries are almost uniformly smoky. The Florida example is more obviously streaked than the others, but differs in no further point.

The ornamentation of the collar is the most characteristic feature of the species, and this tends to getting in red or scarlet in addition to or place of the black.

LEUCANIA MULTILINEA Walker.

Leucania multilinea WALKER, C. B., Mus., Het., IX, 1856, p. 97.

Leucania commoides GROTE, Proc. Ac. Nat. Sci. Phila., 1875, p. 419.

Heliophila lapidaria GROTE, Proc. Ac. Nat. Sci. Phila., 1875, p. 419.—SMITH, Bull. 44, U. S. Nat. Mus., 1893, p. 187, pr. syn.

Ground color creamy yellow. Head immaculate. Thorax with three gray or blackish transverse lines, the upper one broadest. Disk of thorax and patagiæ a little black speckled. Primaries with veins white or whitish, the strigations in the interspaces dark and well marked. Median vein white, inferiorly margined by black or brown to the end. A black dot in the white area at end of vein. A smoky shade bases on vein 4 and broadens toward the apex, which it reaches on outer margin. A dusky shading over the subcostal region and another parallel with and close to inner margin. Transverse posterior line reduced to two dots. A series of small black terminal dots. Secondaries white, with small black terminal dots. Beneath, primaries faintly yellowish, the disk more or less blackish, veins more or less black marked; secondaries somewhat yellowish and powdery along the costa.

Expanse.—1.30 to 1.40 inches (32 to 35 mm.).

Habitat.—Miami, Palm Beach, Florida (Dyar); Harris County, Texas, August 10 (Barnes); Kansas (Snow); Albany, New York, June and July; Winnipeg, Manitoba (Hanham).

A series of thirteen examples shows little variation, and among the strigate rather obtuse winged forms the pure white secondaries of both sexes make this easily separable. The only species with which it is likely to be confounded is *juncicola*, and that can be very easily determined if the material is at all good.

LEUCANIA COMMOIDES Guenée.

Leucania commoides GUENÉE, Spec. Gen., Noct., I, 1852, p. 86.—WALKER, C. B., Mus., Het., IX, 1856, p. 96.—SPREYER, Stett. Ent. Zeit., XXXVI, 1875, p. 113.

Ground color dull grayish luteous, more or less brightened by red strigations. Head tends to rusty brown. Collar with three leaden

gray transverse lines. Thorax a little black powdered. Primaries more or less shaded with red brown and streaked with black. A prominent black streak below the broadly white median vein. A black dot at the branching of the median vein. Veins narrowly white, and hence the costal region is a little paler. A black mark is on the inner margin near the base; another is in the submedian interspace toward the anal angle. Other black streaks are in the interspaces above vein 3, forming the base of a triangular dusky shade. Transverse posterior line punctiform, not well marked. A series of black terminal dots. Secondaries dirty fuscous, with pale yellowish fringes. Beneath, the sexual tuftings are discolored, brown. Primaries reddish gray, powdery, a little darker on the disk. Secondaries whitish, with the costal area powdery, yellowish.

Expanse.—1.40 to 1.50 inches (35 to 37.5 mm).

Habitat.—Nova Scotia; Canada; Winnipeg, Manitoba, July 2 (Hannam); Maine (Fernald); Massachusetts; Albany, New York, June 22 (Bailey); New York, June to August; Wisconsin; Minnesota; Illinois; New Mexico (Snow); Colorado; Florida in March.

The species has a wide distribution, is not at all rare, and is easily recognized. The prominent black streak beneath the white median vein and the dark red color are distinctive characteristics. Add to this the prominent abdominal and leg tuftings of the male and the species becomes unmistakable.

The leg tuftings are as follows: Anterior femora with a continuous fringing of hairy scales beneath, making a thick mass, but no tuft. Tibia with a thick outward scaling, but no tuftings or longer hair. Middle leg somewhat shortened, tibial spurs long, the inner curved and somewhat flattened. Femora with continuous dense fringing of long hair and scales, longer at base. Tibiæ with long hair tufts in front and at sides, capable of brush-like expansion; one at the side may be also capable of fan-like expansion. Posterior femora with long hair fringe basally. Tibiæ with longer hair outwardly toward base, but no brush.

The harpes of the genitalia are densely clothed outwardly with long yellow hair, intermixed with broadly flattened scales, forming a mass that can be fluffily expanded, making neither a definite brush nor fan-like expansion.

LEUCANIA PHRAGMATIDICOLA Guenée.

Leucania phragmatidicola GUENÉE, Spec. Gen., Noct., I, 1852, p. 89.—WALKER, C. B., Mus., Het., IX, 1856, p. 97.

Heliophila phragmatidicola var. *terana* MORRISON, Proc. Bost. Soc. N. H., XVII, 1874, p. 211.

Ground color a very pale luteous, varying to grayish or reddish, sometimes reaching a decided warm fawn brown. Head and thorax concolorous. Collar with three darker transverse lines, which tend

to obsolescence, that just below the tip being broadest. Anterior crest and patagiae sometimes a little speckled with blackish scales. Primaries more or less obviously strigate, the veins white or whitish, interspatial narrow lines ranging from dull luteous to smoky or even blackish. Median vein obviously white, bordered on each side by a smoky or blackish shading, that beneath being the more prominent. At the end of the vein the white enlarges as it includes the base of the branches and here a black dot precedes and a blackish or smoky shade follows the branching, thus extending for a little distance the dark shading below the median vein. A vague triangular cloud is on the outer margin above vein 4, extending to the apex, and a somewhat lighter shading extends from base through the cell, obliquely to the apex itself. A series of small black terminal dots is obvious in most specimens. Secondaries white or whitish, sometimes with a yellowish tinge, with a narrow smoky outer border and a series of terminal black dots, which, as a rule, are best marked where the smoky shading is best. Beneath, primaries creamy or reddish, powdery, tending to smoky on the disk; secondaries white except over the costal region, where it is creamy and somewhat powdery.

Expanse.—1.28 to 1.52 inches (32 to 37 mm.).

Habitat.—Canada to Florida, to Texas, to California; Iowa; Minnesota; Illinois. The dates cover every month from March to October, inclusive.

This is one of the most widely distributed, and, in a certain way, the most variable of the species. There are, obviously, two broods in the Middle Atlantic States, adults appearing in May and June and again in August and September. New Jersey specimens are before me for every month from May to October. In Florida and Texas the early dates are in March. Los Angeles, California, specimens are dated April.

Nearly forty examples are under inspection and in such variety that it would seem certain that they could be arranged in series of distinct forms, but I have failed on all bases tried.

Some specimens are almost creamy yellow, without contrasts, the median vein hardly white, its blackish border hardly traceable. The primaries seem broader, the margins subparallel. Another series is obviously gray, with or without a reddish shade, the strigation obvious, the markings over the median vein conspicuous. Here the wings seem more trigonate and the apices more pointed. Then comes a series in which the primaries seem longer and narrower, the body sligher, color decidedly reddish fawn, the median dusky streak unusually prominent, and extending almost to the transverse posterior line; but when these extremes are carefully separated out, the remaining forms block out every gap and leave us with one series only. The differential points have been elsewhere brought out.

I can not place the variety *texana* Morrison. I have nothing so small as 29 mm. in expanse, and nothing in which the lines on the collar are not at least traceable. The essential differences as pointed out by Mr. Morrison are: "They expand only 29 mm.; the collar lacks the black transverse line of the typical form; the ground color is clear and whitish, not becoming suffused with reddish or dark ochreous before the terminal space."

Mr. Grote in describing *ligata* refers to this variety as if he thought Mr. Morrison might have had such a form as his new species before him, but this seems hardly credible.

LEUCANIA IMPERFECTA Smith.

Leucania imperfecta SMITH, Trans. Am. Ent. Soc., XXI, 1894, p. 76.

Ground color a dull luteous, shaded with smoky or blackish. The head may be of the pale ground or of the smoky tint. Collar with three purplish black transverse lines; patagiæ blackish at base of primaries, tending to the pale ground on the disk. Primaries darker over the costa, through the middle of the wing, along the inner margin, and in the terminal space before the apex. This leaves the pale ground as a long shade through the cell from base to apex and through the submedian interspace from base to the transverse posterior line. The shadings are all quite even and not obviously strigate. Median vein accompanied by a blackish streak which may or may not darken it to the end. At the branching there is always the angular white spot, emphasized by a preceding black dot. In one specimen the vein is narrowly white throughout. The other veins may or may not be partly white marked. There may be a series of small black terminal dots and a yellowish line at the base of the fringes.

Secondaries, transparent, somewhat pearly white at base, the veins smoky or blackish; a somewhat diffuse, smoky margin, variable in width. Fringes with a yellowish line at base. Beneath, primaries gray, powdery, the disk tending to and sometimes all blackish. Secondaries white, powdery over the costal and apical area.

Expanse.—1.28 to 1.52 inches (32 to 38 mm.).

Habitat.—Santa Rita Mountains, Arizona, June 19 (Schwarz); Chiricahua Mountains, Arizona, June 26 (Hubbard); Wilgus, Cochise County, Huachuca Mountains, and southern Arizona (Barnes).

Seven examples from so many localities in Arizona indicate that it is not really a rare species. There seems to be little variation except in size, and that is not sexual, since the largest and smallest examples are both males.

In the male the sexual tuftings are not very prominent. On the anterior legs the femora have a moderate scale fringing at base, becoming shorter toward tip; the tibia is a little scale thickened outwardly. On the middle leg the femoral fringe is a little longer, the tibia is

decidedly thickened with long hair outwardly, not forming obvious tufts. On the posterior legs the femoral fringe is much longer and reaches almost to base; the tibiae have long thin hair which does not form tufts. The anal tuftings are not very dense exteriorly, but there are two pencils of yellow hair within the genital cavity.

LEUCANIA ANTEROCLARA, new species.

Ground color a very pale luteous, almost whitish or creamy. Collar paler with three more or less obvious transverse bands which tend to and sometimes are purplish. Primaries obviously streaky but varying in the amount of contrast. Veins paler, the median whitish, as a rule, and 3 and 4 may be whitish for a part or all their course. A smoky or olivaceous luteous shading below the median vein. Discal dot a mere point which may be altogether absent. Transverse posterior line usually reduced to two black points, never complete. There is a very well-marked tendency to darker streaks above vein 4, emphasizing the triangular dusky subapical shade. In some specimens a series of small black terminal dots is obvious. Secondaries white, with a pearly luster or yellowish tinge in the male, with a vague dusky outer shading, the veins dusky; in the female with a broader, smoky border and the entire wings tending to dusky. Beneath, primaries creamy to reddish, more or less powdery, the disk more or less blackish. Secondaries white, the costal margin creamy, powdery.

Expanse.—1.40 to 1.56 inches (35 to 39 mm.).

Habitat.—Calgary, Alberta, June 25, July 10, August 13 (Dod); Yellowstone Park, Wyoming, August, (Barnes); Corvallis, Oregon, July 6 (Cordley); Glenwood Springs, Colorado, June 10 (Barnes).

Twenty-one specimens are under examination; all the females a little darker and more streaky than the males.

The differences between this species and *phragmatidicola* have been already discussed. Comparing two series their distinctness is obvious; comparing selected individuals of each series the sexual characters might have to be resorted to. It is suggestive of a local form that I have no *phragmatidicola* from the range given for this species, nor any example of this species within the range given for *phragmatidicola*.

In the male the anterior femora have long, scaly fringes more than half the distance from base; the tibiae are thickened with scaly vestiture outwardly. Middle legs with equal femoral fringes for their entire length. Tibiae with long hair, capable of partly fan-like expansion in front and at the sides; the outer spurs short and cylindrical. Posterior femora fringed their full length, the fringe longer at base; tibiae with somewhat longer thin hair outwardly. The harpes are clothed outwardly with dense hair and scales but these do not form prominent tuftings. Altogether the characters, while of the same type as in *phragmatidicola*, are very much reduced.

Type.—No. 6250, U. S. N. M.

LEUCANIA CALGARIANA, new species.

Ground color a pale luteous, overlaid, streaked or washed with red. Collar almost whitish, quite contrasting, crossed by three dark gray transverse lines. Primaries obviously strigate. Median vein conspicuously white; its branches (three and four) also white as a rule and, in addition, most of the other veins are more or less whitish. A blackish or at least darker shade below the median vein and extending vaguely beyond it to form the usual trigonate subapical cloud. Discal black dot small or wanting. Transverse posterior line reduced to two dotlets or altogether wanting. Secondaries white or slightly yellowish, with a more or less obvious smoky margin. Beneath, primaries reddish gray, powdery, tending to a blackish disk. Secondaries white, costal region reddish, powdery.

Expanse.—1.48 to 1.56 inches (37 to 39 mm.).

Habitat.—Calgary, Alberta, June 20 to July 28 (F. H. Wolley Dod).

Ten examples, all from Mr. Dod and all in good condition.

This species is conspicuously different in color from the others of this series and is also the largest in average expanse. It is most nearly allied to *anteroclara* and is that species suffused with red. Whether it is merely a color variety or not I can not now say. Nothing like it has come from other localities. Mr. Dod has sent me about twenty examples of both forms and there is no difficulty whatever in separating the two. I prefer, under the circumstances, to risk the specific name until a careful study of the early stages determines the status of forms.

Type.—No. 6243, U.S.N.M.

LEUCANIA STOLATA Smith.

Leucania stolata SMITH, Trans. Am. Ent. Soc., XXI, 1894, p. 76, pl. v, fig. 8.

Ground color a pale straw yellow. Collar with two transverse dark lines. Patagium with a dusky powdering near the margin. Primaries with the median vein white, a short spur marking the inception of vein 2, while veins 3 and 4 are white a little distance from their point of inception. A smoky brown shade accompanies this line inferiorly, and extends beyond the cell as an elongate dusky triangle between veins 4 and 6, fading out before the margin is reached. A less distinct brownish shade extends along the inner margin, and a vague smoky tinge is apparent over the costal and apical region. Between the veins, beyond the cell, are faint darker longitudinal brown lines, giving the wing there a feebly strigate appearance. A series of small black terminal dots and a small dot at the end of the median vein. Secondaries white. Beneath white, feebly irrorate; primaries with a somewhat yellowish tinge.

Expanse.—1.28 inches (32 mm.).

Habitat.—Arizona.

I have seen nothing like this since the original description was published; hence the type is yet unique.

LEUCANIA OREGONA, new species.

Ground color pale fawn or reddish gray. Collar with two darker transverse lines. Disk of thorax a little powdery. Primaries obviously strigate. Veins white or nearly so, the end of the median forming an obvious white mark emphasized by a preceding black dot. A smoky line below the median vein, extending beyond it above vein 4 to form the usual subapical dusky cloud. Transverse posterior line punctiform, complete. Terminal space and fringes smoky. Secondaries white, with a series of black terminal marks. Beneath reddish gray, powdery; secondaries white, costal region powdery reddish gray.

Expanse.—1.20 inches (30 mm.).

Habitat.—Corvallis, Oregon, at light, April 11 (Cordley).

One male in very fair condition. The species resembles a pale, much reduced *subpunctata*, and is altogether different from anything else in this group.

The femoral fringes are present in a reduced form in this species, and all the tibiae have long, thin, hairy clothing, but not any of them have it to form tufts of any kind.

LEUCANIA ROSEOLA Smith.

Leucania roseola SMITH, Trans. Am. Ent. Soc., XXI, 1894, p. 75, pl. v, fig. 9.

Ground color very pale yellow, suffused with red of varying shade, tending to light brick red. Collar with three somewhat darker transverse lines. Primaries with veins paler, the intervals so closely strigate that the impression is given of an almost even color. Median vein not contrasting, only a little paler at tips. No obvious discal dot, but a slightly dusky shading beyond the forking. Transverse posterior line a complete series of smoky dots or absent altogether, with all the intermediate forms and everything in favor of the obsolescence of the dots. Secondaries white. Beneath reddish gray, the primaries with an irregular outer venular band. Secondaries white, except on the costal area.

Expanse.—1.46 to 1.50 inches (36 to 39 mm.).

Habitat.—Pullman, Washington, June 12 (Piper); Corvallis, Oregon, June 20 (Cordley); British Columbia in July; Livingston, Vancouver, July 11.

Eight examples are at hand just now and I have seen others. The most uniform red color of the wing without any contrasts identifies *roseola* as compared with *areola*.

LEUCANIA FARCTA, Grote.

Heliophila farcta GROTE, Can. Ent., XIII, 1881, p. 15.

Leucania farcta SMITH, Bull. 44, U. S. Nat. Mus., 1893, p. 188.

Ground color a pale creamy yellow. Collar with three somewhat purplish transverse lines. Primaries strigate, but without contrasts. The median vein is white or whitish, without contrast or obvious margins. A black dot at the end of the cell. Transverse posterior line reduced to two black points. A faint triangular cloud below apex. A series of black terminal dots. Secondaries white. Beneath, primaries yellowish, only a little powdered on the disk; secondaries with powdery costa and some black dots on the outer margin.

Expanse.—1.46 to 1.56 inches (36.5 to 39 mm.).

Habitat.—Los Angeles, California, April 16 (Howard); Los Angeles County, in April (Koebele); Fresno, California (Schwarz); Sierra Nevada (Henry Edwards).

Five examples are under examination; all very much alike. The species is an easily recognizable one with its very pale colors and simple, obscure maculation.

LEUCANIA PALLISECA, new species.

Ground color a very pale whitish yellow. Collar with three dusky transverse bands. Primaries feebly and not contrastingly strigate, all ordinary markings reduced to the vanishing point. Median vein scarcely defined in any way. Discal dot minute or wanting. Transverse posterior line consists of very small black dots and is never complete; sometimes wanting. A series of minute terminal dots. Secondaries pure white, immaculate. Beneath, white; primaries with a creamy tint and a little tendency to darken on the disk; secondaries a little powdery over the costal region.

Expanse.—1.25 to 1.45 inches (31 to 36 mm.).

Habitat.—Los Angeles County, California, in July (U.S.N.M.); Fresno, California (Schwarz); Denver, Colorado, May and October.

Seven examples are at hand and are about as nearly immaculate as a species in this series can well be. Oddly enough, all the specimens are females, and I was at first inclined to consider them female *farcta*; but I have that sex fully agreeing with the male, and therefore prefer to consider this a good species.

Type.—No. 6251, U.S.N.M.

NELEUCANIA, new genus.

Eyes hairy, without bristly lashes, round, convex, not prominent. Head as a whole moderate in size, retracted rather than prominent, but not strongly defined either way, vestiture loose, fine hair, giving a smooth woolly appearance. Palpi moderate or rather short, oblique,

reaching to and sometimes exceeding middle of front, rather slender, the terminal joint proportionately rather long, oblique or even drooping, vestiture loose. Antennae in the male feebly ciliated. Thorax moderately developed, with loose, long, thin vestiture forming no tufts and leaving collar and patagiae undefined. Abdomen reaching to or exceeding the hind angle of secondaries, more often longer and somewhat disproportionately slight. Legs unarmed except for the usual tibial spurs, in the male with more or less well-marked sexual tuftings, which are most obvious on the middle tibiae. Primaries rather narrow, elongate, the costa a little depressed, apices a little pointed, outer margin a little arcuate or entirely rigid, oblique.

The male genitalia are of the same type in all, and very much alike: there is a pair of oblong harpes, rounded at the tip, broadly or narrowly as the case may be, not modified or spined in any way, and on each a single curved corneous clasper, varying somewhat in the species.

The genus differs from *Leucania* chiefly in the narrow subequal primaries, having the costa depressed, the outer margin rather rigidly cut off, and in the long abdomen. The loose, hairy vestiture, forming no tufts and leaving the thoracic parts undefined, adds to the distinctive appearance.

As a whole the species resemble each other closely. The primaries range from pale creamy yellow to reddish, the costal edge white in the species known to me, median vein usually white and usually a dusky longitudinal shade through the middle.

Niveicosta is the best marked and a little the more robust of the species, the body parts being stouter in proportion than in any of the others. The primaries are reddish luteous, the costa narrowly yet distinctly white. The median vein is also white, though not prominently so, and it is usually accompanied by a well-marked dusky shading which may reach very close to the outer margin. The transverse posterior line is punctiform and completely traceable in all the specimens. The secondaries are slightly smoky, with a faint reddish or yellowish tinge. The male has a fringing of thin hair on the under side of the anterior and posterior femora, and on the middle femur there is an expansile tuft of hair at the base. The anterior and posterior tibiae are hairy, but not really tufted; the middle tibia has a dense brush or tuft of hair extending all the way down the outer side, and this is capable of fan-like expansion. All the specimens are from Colorado.

Bicolorata has the primaries a very pale yellow and the secondaries reddish. In some specimens the wings are practically immaculate, and of this form was the type of the species. In most good examples, however, the white costa and median vein are obvious, and in one specimen the punctiform transverse posterior line is almost complete. The body is smaller and the abdomen in both sexes is much longer than in the preceding species.

The sexual tuftings are as in the preceding species, but all very much exaggerated. The middle tibia is somewhat abbreviated and the tuftings when expanded form an almost complete circle. The posterior femur and tibia have each a tuft at base, in the former extending beyond, in the latter to the middle of the respective parts.

This species seems to have a wider distribution, extending from Colorado into Arizona and New Mexico.

Citronella is decidedly smaller than the preceding two species. The primaries are pale luteous, with a vague smoky tinge, and the secondaries are decidedly smoky in both sexes. The primaries have the costal edge white, and in all of them the smoky shade along the median vein and extending nearly to the outer margin is well marked; but the white along the median vein itself may be entirely wanting. The transverse posterior line is punctiform, complete, and well marked in all the specimens. The sexual characters are in essentials like those of *bicolorata*, but not nearly so prominent. All the examples are from Colorado.

The three species above defined are closely allied, but, I think, really distinct. With a good series, such as I have had under examination, the differences become clear, and with any good specimens under examination there should be no difficulty in placing even single examples.

Patricia is entirely different. The primaries are very pale creamy yellow or almost white, with an obvious smoky or blackish streak through the middle from base to the outer margin. The secondaries are smoky white, and as a whole the species looks white. It is about the size of *citronella*, but looks smaller and really is slighter. The sexual tuftings in the male are so reduced as to be scarcely noticeable except on close inspection. The species occurs in Colorado and New Mexico.

Prægracilis belongs here without much doubt. Mr. Grote says that it is a very slight species, yellow white and absolutely immaculate. I have not seen it. The type is from Idaho.

In tabular form the species known to me may be arranged as follows:

Primaries reddish luteous, with a punctiform transverse posterior line; secondaries whitish or smoky	<i>niveicosta</i> .
Primaries light yellow, immaculate; secondaries reddish	<i>bicolorata</i> .
Primaries light yellow, with a punctiform transverse posterior line; secondaries white or smoky, size smaller	<i>citronella</i> .
Primaries pale creamy, with a central smoky stripe; secondaries smoky white, size small	<i>patricia</i> .
Primaries yellow white, absolutely immaculate; very slight	<i>prægracilis</i> .

NELEUCANIA NIVEICOSTA, new species.

Ground color reddish luteous, verging to brick red. Head and collar darker, more red-brown. Thoracic disc of the ground color.

Primaries without contrasts of any kind. Costa narrowly but distinctly white. Median vein white, not broadly or prominently so, in some cases with a short white extension on the branches. There is a vague darkening through the middle of the wing, but not a real shade. Transverse posterior line indicated by a more or less complete series of venular black dots. It is not complete in any example before me; but in no case is there any doubt of its presence in great part. A series of minute black terminal dots. Secondaries whitish to smoky, even. Beneath white, ranging from almost immaculate to densely powdered. Primaries tending to a pinkish suffusion and sometimes to a black disk.

Expanse.—1.10 to 1.25 inches (27.5 to 31 mm.).

Habitat.—Glenwood Springs, Colorado, June, July, August, and September.

Five examples, all from Dr. William Barnes, and all save one in good condition. There is very little variation, and except in the somewhat lighter or deeper tint of the primaries and a little difference in the number of spots composing the transverse posterior line the specimens are the same.

Type.—No. 6252, U.S.N.M.

NELEUCANIA BICOLORATA Grote.

Heliophila bicolorata GROTE, Papilio, I, 1881, p. 154.

Leucania bicolorata SMITH, Bull. 45, U. S. Nat. Mus., 1893, p. 185.

"Male, eyes hairy; thorax untufted; tibiae unarmed. Fore wings and thorax light straw color, immaculate, concolorous. Hind wings and abdomen pale reddish. Beneath the wings are shaded with reddish, like secondaries above. There are no markings whatever."

Expanse.—1.12 to 1.25 inches (28 to 31 mm.).

Habitat.—Colorado (Bruce); Glenwood Spring, Colorado, August 25 (Barnes); Merino Valley, New Mexico, June 26 (Wheeler Exp.); Chiricahua Mountains, Arizona, June 26 (Hubbard); Tucson, Arizona.

Six specimens are at hand, all agreeing in a general way with the above description, which is copied from Mr. Grote's original characterization. In most of them, however, the costa and median vein are obviously whitish, and in three specimens a few minute black dots indicate the transverse posterior line.

NELEUCANIA CITRONELLA, new species.

Ground color a dirty pale lemon yellow with a smoky tinge. Head and collar darker, more decidedly smoky. Primaries with the costa narrowly white, the median vein at least partly white marked. Transverse posterior line punctiform, complete in the specimens before me. A black dot on internal vein indicates the location of the transverse anterior line. A series of small black terminal dots. The

secondaries range from dirty white to smoky. Beneath, ranging from almost immaculate whitish to dirty fuscous or yellowish; sometimes with only the disk of primaries blackish.

Expanse.—1.08 to 1.15 inches (27 to 29 mm.).

Habitat.—Denver, Colorado, July 15 (Bruce, Oslar); Glenwood Springs, Colorado, July 16–August 16.

Six examples all very much alike above and no two alike beneath. There is more difference in the color of the secondaries than in the primaries, and on the whole not enough anywhere to cause doubt.

Type.—No. 6253, U.S.N.M.

NELEUCANIA PATRICIA Grote.

Heliophila patricia GROTE, Bull. Bkln. Ent. Soc., III, 1880, p. 46.

Leucania patricia SMITH, Bull. 44, U. S. Nat. Mus., 1893, p. 186.

"Fore wings yellowish buff. A silvery-white stripe on the median vein, extending on vein 4. Above this a dusky stripe, from the base outwardly to near the margin. Veins and costal edge whitish. Thorax buff. Hind wings white. Beneath whitish."

Expanse.—1.05 to 1.12 inches (26 to 28 mm.).

Habitat.—Colorado (Bruce); Las Vegas, New Mexico; Hot Springs, New Mexico, 7,000 feet (Hulst).

Only three examples are before me at present; but I have seen others and noted no essential differences. The species is so unlike any other as to be recognizable at a glance.

NELEUCANIA PRÆGRACILIS Grote.

Heliophila prægracilis GROTE, Bull. Geol. Surv., III, 1877, p. 119.

Leucania prægracilis SMITH, Bull. 44, U. S. Nat. Mus., 1893, p. 185.

"The most slender species of the genus. Eyes hairy. Smaller and slighter than *pallens*. Yellow white, not buff as in *pallens*, absolutely immaculate. Head and thorax more yellowish. Length of primary 12 mil. One specimen, Idaho, July 6. This species seems slighter than *Senta defecta* (Ht.)."

The above is Mr. Grote's description, and I can add nothing to it from personal knowledge. Colorado and New Mexico are cited as additional localities in my catalogue, but I can not now remember on what authority.

Of the species catalogued by me in 1893 and not elsewhere referred to in this paper, *Leucania rufostriqua* is a *Canadrima* and probably the species described by me as *C. punctivena*. Dr. Packard's type is in the Museum of Comparative Zoology at Cambridge, and Mr. Henshaw very kindly compared with it a Labrador example which Dr. Dyar suggested might have been intended. The suggestion proved accurate and I believe that the differences between this example and the British-American specimens are not sufficient to hold my species.

Leucania ebriosa Guenée is a Tasmanian form, Sir George F. Hampson declares, and I am quite ready to believe him. I doubted the "Am. Sept." habitat when I saw the insect in 1892.

Leucania obusta Guenée is also said to be Tasmanian; but this subject is elsewhere referred to.

Of all the species described from our fauna there is one only that I have not seen.

LIST OF THE SPECIES.

Leucania Ochs.

lutina Smith.
relutina Smith.
 unipuncta Harvey.
extranea Guenée.
 pseudargyria Guenée.
 var. *callida* Grote.
 pilipalpis Grote.
 subpunctata Harvey.
complicata Strecker.
 luteopallens Smith.
pallens Auct. Amer.
 minorata Smith.
 oxygale Grote.
 rubripallens Smith.
 pertracta Morrison.
 rubripennis Grote and Robinson.
 albilinea Hubner.
henrici Grote.
 obscurior Smith.
 diffusa Walker.
moderata Walker.
 limitata Smith.
 tetera Smith.
 neptis Smith.
 ligata Grote.
 fiabilis Grote.
 rimosa Grote.
 dia Grote.
 megadila Smith.

Leucania Ochs—Continued.

heterodoxa Smith.
 insueta Guenée.
adonea Grote.
mimica Strecker.
 extincta Guenée.
linita Guenée.
scirpiicola Guenée.
amygdulina Harvey.
 juncicola Guenée.
adjuta Grote.
 multilinea Walker.
lapidaria Grote.
 commoides Guenée.
 phragmatidicola Guenée.
 var. *texana* Morrison.
 imperfecta Smith.
 anteroclara Smith.
 calgariana Smith.
 stolata Smith.
 oregona Smith.
 roseola Smith.
 faretta Grote.
 palliseca Smith.
 Neleucania Smith.
 niveicosta Smith.
 bicolorata Grote.
 citronella Smith.
 patricia Grote.
 prieigracilis Grote.

EXPLANATION OF PLATES.

PLATE V.

1. Harpe and clasper of male *Leucania unipuncta*.
2. Harpe and clasper of male *Leucania subpunctata*.
3. Harpe and clasper of male *Leucania luteopallens*.
4. The structures in *Leucania oxygale* and *Leucania rubripallens* are practically identical.
5. Harpe and clasper of male *Leucania minorata*.
6. Harpe and clasper of male *Leucania pallens* (European).
7. Harpe and clasper of male *Leucania rubripennis*.
8. Harpe and clasper of male *Leucania albilinea*.
9. The characters of *Leucania obscurior* are practically identical.
10. Harpe and clasper of male *Leucania diffusa*.

SMITHSONIAN INSTITUTION.
UNITED STATES NATIONAL MUSEUM.

A LIST OF SPIDERS COLLECTED IN ARIZONA
BY MESSRS. SCHWARZ AND BARBER
DURING THE SUMMER OF 1901.

BY

NATHAN BANKS,
Custodian, Section of Arachnida.

From the Proceedings of the United States National Museum, Vol. XXV, pages 211-221
(with Plate VII).

[No. 1284.]



WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1902.

A LIST OF SPIDERS COLLECTED IN ARIZONA BY MESSRS.
SCHWARZ AND BARBER DURING THE SUMMER OF
1901.

By NATHAN BANKS,
Custodian, Section of Arachnida.

During the summer of 1901, Mr. E. A. Schwarz and Mr. H. Barber collected extensively in parts of Arizona, especially in the vicinity of Williams. In the following pages is a list of the Arachnida that they collected. In a previous paper¹ I have reported on a collection made by Mr. Schwarz in southern Arizona. There is, however, very little similarity in these two collections. The one made during the past summer contains a great many northern species; in fact, a large majority of them occur in Colorado.

In this list there are recorded 64 spiders and 13 other arachnids, a total of 77 species. In the previous article there were 55 species, 37 of which are not found in this list; this makes the total number of arachnids recorded from Arizona 114.

Of the spiders in this list the Attidæ are represented by 13 species, the Thomisiidæ by 12 species; none of the other families have more than 8 species. Three species are described as new.

This material forms part of the collections of the United States National Museum.

Order ARANEIDA.

Family THERAPHOSIDÆ.

EURYPELMA RUSTICUM Simon.

Eurypelma rusticum SIMON, Act. Soc. Linn. Bord., XLIV, 1892, p. 323.

One female, not quite mature, from Williams, June 2.

Family FILISTATIDÆ.

FILISTATA HIBERNALIS Hentz.

Filistata hibernalis HENTZ, Journ. Bost. Soc. Nat. Hist., IV, 1842, p. 227.

A few specimens from Williams, June 10 and July 1.

¹Proc. U. S. Nat. Mus., XXIII, 1901, pp. 581-590.

Family PHOLCIDÆ.

PSILOCHORUS PULLULUS Hentz.

Pholcus pullulus HENTZ, Journ. Bost. Soc. Nat. Hist., VI, 1850, p. 282.

Several specimens from Williams, July 4, 9-15, and 19. A specimen, June 14, has an egg mass of about 25 eggs, rather loosely attached together.

Family DRASSIDÆ.

DRASSUS COLORADENSIS Emerton.

Drassus coloradensis EMERTON, Bull. U. S. Geol. Surv. Terr., III. Pt. 2, 1877, p. 528.

One female specimen, which I think belongs to this species, from Williams, June 9-15. A figure is given of the vulva.

DRASSODES, sp.

An immature specimen from Williams, June 9-15.

HERPYLLUS ECCLESIASTICUS Hentz.

Herpyllus ecclesiasticus HENTZ, Journ. Bost. Soc. Nat. Hist., V, 1847, p. 455.

A few females from Williams, June 9-15 and May 25.

PROSTHESIMA BARBERI, new species.

Cephalothorax and sternum pale brownish, or rather reddish yellow, darker in front; mandibles red-brown; legs somewhat paler than the cephalothorax; abdomen nearly uniform gray above and below; region of epigynum reddish brown. Cephalothorax not very long but much narrowed in front; mandibles rather prominent; legs somewhat shorter than usual; sternum one and one-fourth longer than broad, broadest at middle, pointed behind; abdomen depressed, truncate at base, with tufts of hairs, one and two-thirds as long as broad, pointed behind; spinnerets prominent. Posterior eye-row nearly straight, but little longer than anterior row; posterior middle eyes oval, less than one-half their diameter apart, fully diameter from rather larger posterior side eyes; anterior middle eyes smaller, about diameter apart, not so far from the large anterior side eyes, which are about their diameter from the equal posterior side eyes; quadrangle of middle eyes higher than broad and broader behind than in front; no spurs under tibiae I and II, a pair toward base on these metatarsi.

Length, 6 mm.

Several specimens, Williams, in May and June, and Winslow, July 21. One, May 29, has an egg-coboon, which is of the usual shape, with a plain covering, devoid of any foreign substance, and contains about 30 eggs.

PŒCILOCHROA MONTANA Emerton.

Pœcilochroa montana EMERTON, Trans. Conn. Acad., VIII, 1890, p. 11.

One female from Bright Angel, August 10.

GRAPHOSA CONSPERSA Thorell.

Graphosa conspersa THORELL, Bull. U. S. Geol. Surv. Terr., III, Pt. 2, 1877, p. 489.

One immature specimen from Williams, July 23, evidently belongs to this common northern species.

MICARIA, sp.

An immature specimen from Winslow, July 31, is quite possibly an undescribed species.

Family **CLUBIONIDÆ**.**CHIRACANTHIUM INCLUSUM** Hentz.

Clubiona inclusa HENTZ, Journ. Bost. Soc. Nat. Hist., V, 1847, p. 451.

Specimens come from Bright Angel, July 13 (Colorado Canyon, 3,500 feet), and Prescott, June 20.

CLUBIONA, sp.

Immature specimens from Williams, June 9-15.

Family **DICTYNIDÆ**.**DICTYNA SUBLATA** Hentz.

Theridion sublatum HENTZ, Journ. Bost. Soc. Nat. Hist., VI, 1850, p. 276.

A few specimens from Williams, June 5.

LETHIA TRIVITTATA Banks.

Lethia trivittata BANKS, Proc. Acad. Nat. Sci. Phila., 1901, p. 577.

A female from Williams, July.

TITANŒCA AMERICANA Emerton.

Titanœca americana EMERTON, Trans. Conn. Acad., VII, 1888, p. 453.

Specimens from Williams, June 5. It is a northern species, but I have seen specimens from near Las Vegas, New Mexico.

Family **AGALENIDÆ**.**AGALENA NÆVIA** Hentz.

Agalea nœvia HENTZ, Journ. Bost. Soc. Nat. Hist., V, 1847, p. 465.

A few examples from Williams, June 9-15, and July 1. They do not differ from many Eastern specimens.

HAHNIA, sp.

One female from Williams, June 5. It is a small species, with a dark abdomen marked above with four prominent transverse spots, the anterior one interrupted in the middle.

Family THERIDIIDÆ.**LATHRODECTES MACTANS Fabricius.**

Aranea mactans FABRICIUS, Entom. Syst., II, 1775, p. 410.

A young specimen from Bright Angel, August 10.

THERIDIUM MURARIUM Emerton.

Theridium murarium EMERTON, Trans. Conn. Acad., VI, 1882, p. 11.

Various specimens from Williams, June 9-15, July 20-27; and Bright Angel, August 10.

LITHYPHANTES COROLLATUS Linnaeus.

Aranea corollata LINNÆUS, Syst. Nat., X, 1758, p. 621.

Several specimens from Williams, June 9-15, July 19.

LITHYPHANTES MEDIALIS Banks.

Lithyphantes medialis BANKS, Proc. Cal. Acad. Sci., (3), Zool., I, 1898, p. 240.

A specimen from Prescott, June 20. This species was described from Mexico, and this is the first record of its occurrence in the United States.

STEATODA GRANDIS Banks.

Steatoda grandis BANKS, Proc. Acad. Nat. Sci. Phila., 1901, p. 578

Specimens from Williams, June 8-15 and July 4.

DIPCENA NIGRA Emerton.

Steatoda nigra EMERTON, Trans. Conn. Acad., VI, 1882, p. 21.

A female from Williams, July 27.

EURYOPIS FUNEBRIS Hentz.

Theridium funebre HENTZ, Journ. Bost. Soc. Nat. Hist., VI, 1850, p. 276.

Various specimens from Williams, May 25, June 9-15, and July 4, 17, and 19.

ERIGONE, sp.

One female from Williams, May 25. It is pale yellowish, with a gray abdomen, marked behind by pale chevrons.

Family EPEIRIDÆ.

EPEIRA GEMMA McCook.

Epeira gemma McCook, Proc. Acad. Nat. Sci. Phila., 1888, p. 193.

Several females from Williams, May 25, June 9-15, and July 27.

EPEIRA CONCHLEA McCook.

Epeira conchlea McCook, Proc. Acad. Nat. Sci. Phila., 1888, p. 199.

One female from Hot Springs, June 21-28; another from Bright Angel, July 10.

EPEIRA DISPLICATA Hentz.

Epeira displicata HENTZ, Journ. Bost. Soc. Nat. Hist., V, 1847, p. 476.

A female from Williams, July 20-27.

TETRAGNATHA EXTENSA Linnæus.

Aranea extensa LINNÆUS, Syst. Nat., XII, 1767, p. 621.

Several specimens from Colorado Canyon, July 13, and Williams, June 9-15.

Family THOMISIIDÆ.

XYSTICUS FORMOSUS Banks.

Xysticus formosus BANKS, Proc. Acad. Nat. Sci. Phila., 1892, p. 56.

Specimens from Williams, May 29, June 5, July 1, and Bright Angel, August 10.

XYSTICUS DISCURSANS Keyserling.

Xysticus discursans KEYSERLING, Die Spinn. Amer., I, Latr., 1880, p. 20.

One specimen from Williams, July 1-4.

XYSTICUS BENEFACITOR Keyserling.

Xysticus benefactor KEYSERLING, Die Spinn. Amer., I, Latr., 1880, p. 22.

One pair from Williams, June 5 and July 20.

XYSTICUS LOCUPLES Keyserling.

Xysticus locuples KEYSERLING, Die Spinn. Amer., I, Latr., 1880, p. 24.

Many specimens from Williams, June 9-15, July 5, and Bright Angel, July 10.

MISUMENA DIEGOI Keyserling.

Misumena diegoi KEYSERLING, Verh. zool.-bot. Ges. Wien, 1887, p. 481.

Many specimens from Williams, June 9-15, May 25, and July 23; also from Hot Springs, June 21-28.

MISUMENA GEORGIANA Keyserling.

Misumena georgiana KEYSERLING, Die Spinn. Amer., I, Latr., 1880, p. 86.

Several specimens from Williams, July 27.

CORIARACHNE VERSICOLOR Keyserling.

Coriarachne versicolor KEYSERLING, Die Spinn. Amer., I, Latr., 1880, p. 53.

A few specimens from Williams, June 5, July 1-4, and July 27.

TMARUS CAUDATUS Hentz.

Thomisus caudatus HENTZ, Journ. Bost. Soc. Nat. Hist., V, 1847, p. 447.

Various specimens from Williams, June 5, July 1 and 4; also from Prescott, June 20.

TIBELLUS DUTTONI Hentz.

Thomisus duttoni HENTZ, Journ. Bost. Soc. Nat. Hist., V, 1847, p. 448.

A few specimens from Colorado Canyon, July 13.

THANATUS COLORADENSIS Keyserling.

Thanatus coloradensis KEYSERLING, Die Spinn. Amer., I, Latr., 1880, p. 206.

Several examples from Williams, June 9-15, and Bright Angel, August 10.

PHILODROMUS PRÆLUSTRIS Keyserling.

Philodromus prælustris KEYSERLING, Die Spinn. Amer., I, Latr., 1880, p. 209.

Many specimens from Williams, June 5, July 19; Hot Springs, June 21-28, and Bright Angel, August 10.

PHILODROMUS RUFUS Walckenaer.

Philodromus rufus WALCKENAER, Faune de France, Arach., 1825, p. 91.

A few specimens from Williams, May 25 and June 9-15.

Family SPARASSIDÆ.

OLIOS FASCICULATUS Simon.

Olios fasciculatus SIMON, Act. Soc. Linn. Bord., 1880, p. 87.

One specimen from Hot Springs, June 21-24. Previously known only from the Pacific coast.

Family LYCOSIDÆ.

DOLOMEDES SCRIPTUS Hentz.

Dolomedes scriptus HENTZ, Journ. Bost. Soc. Nat. Hist., V, 1847, p. 189.

One female and a young specimen from Hot Springs, June 27. A common Eastern species.

TROCHOSA CINEREA Fabricius.

Aranea cinerea FABRICIUS, Entom. Syst., II, 1793, p. 423.

One specimen from Hot Springs, June 21-28.

TROCHOSA PARVA Banks.

Trochosa parva BANKS, Journ. N. Y. Ent. Soc., 1894, p. 52.

Several specimens from Colorado Canyon, July 13.

LYCOSA SCALARIS Thorell.

Tarentula scalaris THORELL, Bull. U. S. Geog. Surv. Terr., III, Pt. 2, 1877, p. 520.

A couple of specimens from Williams, June 9-15. Very common in Colorado and the Northwest.

LYCOSA, sp.

Two females of a large species, without very distinctive characters, from Williams, May 25 and July 20. It is allied to *L. riparia*, and may be only a form of that species.

PARDOSA STERNALIS Thorell.

Lycosa sternalis THORELL, Bull. U. S. Geog. Surv. Terr., III, Pt. 2, 1877, p. 504.

A few specimens from Williams, June 9-15; Prescott, June 20, and Flagstaff, July 5. A common species in Colorado.

PARDOSA, sp.

A female from Williams, July. Apparently of an undescribed species.

Family OXYOPIDÆ.

OXYOPES COMPACTA Banks.

Oxyopes compacta BANKS, Trans. Amer. Ent. Soc., XXIII, 1896, p. 72.

Various specimens from Williams, June 5; Bright Angel, August 10, and Prescott, June 20. Known previously only from Colorado.

HAMALATIWA GRISEA Keyserling.

Hamalatin grisea KEYSERLING, Verh. zool.-bot. Ges. Wien, 1887, p. 457.

Specimens from Hot Springs, June 21-28. Widely distributed in the South.

Family ATTIDÆ.

PHIDIPPUS BICOLOR Keyserling.

Phidippus bicolor KEYSERLING, Verh. zool.-bot. Ges. Wien, 1884, p. 496.

One pair from Williams, July 20 and 26. A common species in the arid region of the West.

PHIDIPPUS, sp.

A mature female from Williams, July 19, catching a *Pieris*; a young specimen from Prescott. A very handsome species which, I think, is as yet undescribed.

COLONUS RETARIUS Hentz.

Attus retarius HENTZ, Journ. Bost. Soc. Nat. Hist., VI, 1850, p. 288.

One young specimen from Hot Springs, January 21-28.

DENDRYPHANTES OCTAVUS Hentz.

Attus octavus HENTZ, Journ. Bost. Soc. Nat. Hist., V, 1847, p. 365.

Several specimens from Williams, June 9-15, July 21, and May 25; also from Prescott, June 20, and Hot Springs, June 21-28.

DENDRYPHANTES, sp.

A few females from Williams, July 9-15.

ASTIA MOROSA Peckham.

Astia morosa PECKHAM, Trans. Wisc. Acad. Sciences, VII, 1888, p. 71.

One female from Williams, July. An uncommon species, and as yet known only from the female.

ERGANE BOREALIS Blackwell.

Sallicus borealis BLACKWELL, Ann. Mag. Nat. Hist., XVII, 1846, p. 35.

One female from Williams, July 1-4; a pale specimen.

PELLENES ELEGANS Peckham.

Pellenes elegans PECKHAM, Bull. Wisc. Nat. Hist. Soc., Oct., 1900, p. 220.

Pellenes dolosus PECKHAM, Bull. Wisc. Nat. Hist. Soc., Oct., 1900, p. 222.

Specimens from Hot Springs, June 21-28, and Bright Angel, August 10.

ICIUS SIMILIS Banks.

Icius similis BANKS, Can. Entom., 1895, p. 100.

A young specimen from Prescott, June 20.

ICIUS, sp.

An immature specimen, of a species unknown to me, from Colorado Canyon, July 13.

MARPISSA CALIFORNICA Peckham.

Marpiessa californica PECKHAM, Trans. Wisc. Acad. Sciences, VII, 1888, p. 81.

One female from Hot Springs, June 21-28.

MARPISSA ALBOPILOSA, new species.

Cephalothorax black, with a broad area of white hairs, narrowed in front between the anterior middle eyes, where it passes down on the clypeus; a white stripe on the side margins; sternum and coxæ reddish, with long white hair. Abdomen black, above with many white hairs, giving it a mottled gray appearance; venter more gray, with many white hairs; legs with black hair above, long white hair beneath and on outer side, shorter, adpressed, elongate, scale-like hair above and on sides, scattered among the other hairs. Cephalothorax long and flat, broadest in the middle, tapering each way; abdomen long and slender, depressed; region of epigynum elevated, corneus, and rugose, displaying two large cavities in the anterior portion. Legs short and stout, the anterior pair especially thickened, the spines few and reduced in size; under tibia I there is but one spine toward tip, two pairs under or rather on the lower sides of metatarsus I; spines on hind legs few, but more slender; sternum narrow, the anterior coxæ separated by less than the width of lip.

Length, 6.5 mm.

Two specimens from Williams, in July. A very interesting species of a hoary appearance.

SYNAGELES SCORPIONA Hentz.

Symenosyna scorpiona HENTZ, Journ. Bost. Soc. Nat. Hist., V, 1847, p. 369.

Two specimens from Williams, July 1-4.

Order PHALANGIDA.**Family PHALANGIDÆ.****PROTOLOPHUS TUBERCULATUS** Banks.

Protolophus tuberculatus BANKS, Can. Entom., 1893, p. 206.

A few specimens from Williams, June.

LIOBUNUM TOWNSENDI Weed.

Liobunum townsendi WEED, Amer. Nat., 1893, p. 295.

Many specimens from Williams, July 17, 18, 21; also Bright Angel, August 10.

Order SCORPIONIDA.**Family VEJOVIDÆ.****VEJOVIS BOREUS** Girard.

Scorpio boreus GIRARD, Marcy's Rept. Expl. Red River, 1854, p. 238.

Several specimens from Williams, May 25, July 9-15; Bright Angel, August 10; Winslow, July 31, and Prescott, June 20.

Order PSEUDOSCORPIONIDA.

Family CHELIFERIDÆ.

CHELIFER SCABRISCULIS Simon.

Chelifer scabrisculis SIMON, Ann. Soc. Ent. France, 1878, p. 154.

Many specimens from Williams, May 25, June 6.

CHELANOPS GROSSUS Banks.

Chelanus grossus BANKS, Can. Entom., 1893, p. 65.

Many specimens from Williams, June 9-15, July 7. Some specimens taken in June bear the egg-mass, consisting of about twenty eggs tightly bound together and forming a flattened hemisphere. Two specimens were found under the elytra of a beetle, *Ergates spiculatus*, taken July 17 at Williams.

OLPIUM, sp.

One specimen, of an obscure species; Williams, July.

Order SOLPUGIDA.

Family EREMOBATIDÆ.

EREMOBATES SULFUREUS Simon.

Datumen sulfureus SIMON, Ann. Soc. Ent. France (5), IX, 1879, p. 142.

Several specimens from Williams, May 25, June 10; Bright Angel, August 10, and Flagstaff, July 5.

Order ACARINA.

Family RHYNCHOLOPHIDÆ.

RHYNCHOLOPHUS ROBUSTUS Banks.

Rhyncholophus robustus BANKS, Ann. N. Y. Acad. Science, VIII, 1895, p. 432.

Several specimens from Williams, June 9-15; also a number of their eggs.

RHYNCHOLOPHUS MACULATUS Banks.

Rhyncholophus maculatus BANKS, Trans. Amer. Ent. Soc., 1894, p. 217.

A few specimens from Williams, June.

RHYNCHOLOPHUS, sp.

One specimen of a broad, pale yellowish species, from Winslow, July 21.

Family GAMASIDÆ.

GAMASUS, sp.

A few specimens taken at Williams, May 23, in a nest of a *Lasius*.

DISCOPOMA HIRSUTA, new species.

Pale yellowish throughout. Body a little broader than long; convex above; rather broader in front, and slightly pointed behind; its sides almost parallel. Dorsum smooth, quite thickly covered with long, slender, erect hairs. Sternum nearly as wide behind as in front, its surface, as well as that of the ventral plate, very finely granulate. Legs short and stout, of usual shape, provided with a few hairs.

Length, 0.62 mm.

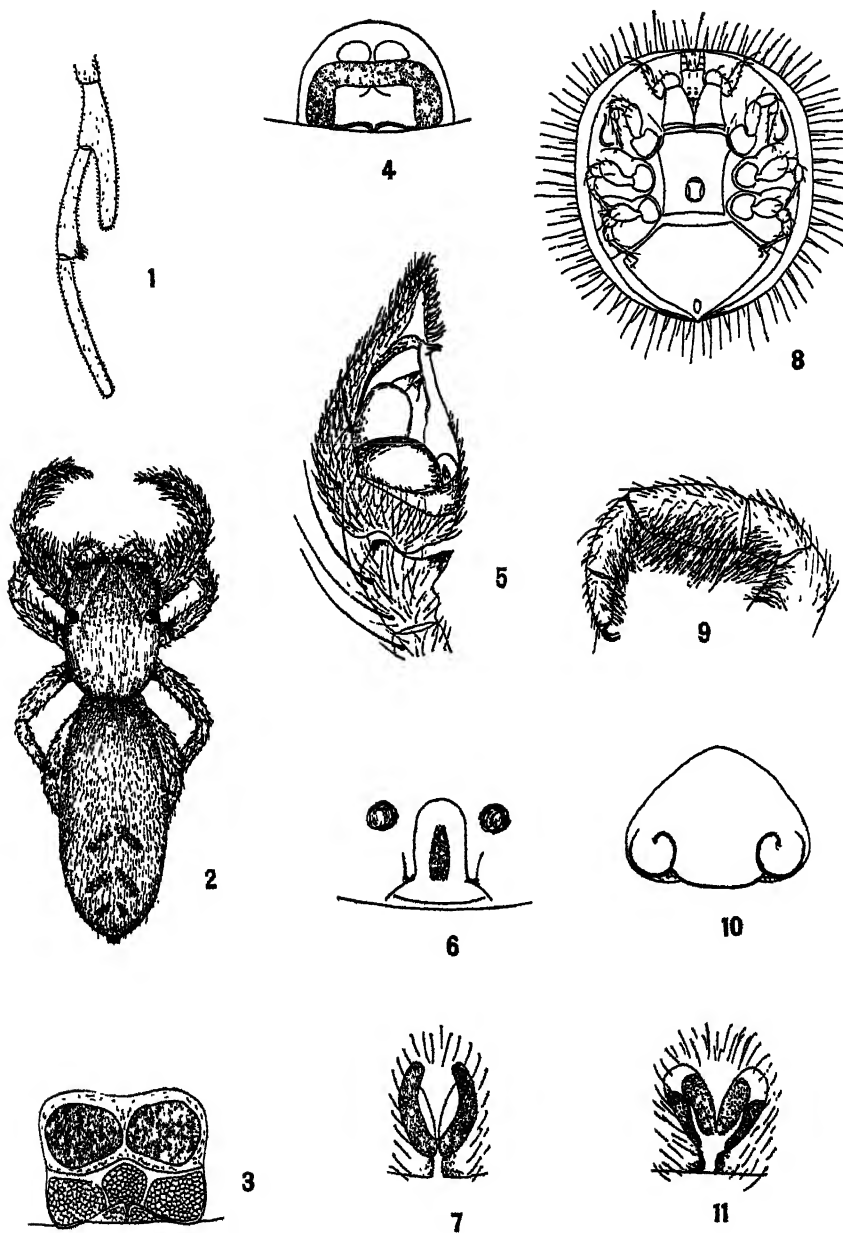
Taken at Williams June 1, with a species of *Lasius*. It differs from our other species of *Discopoma* (*D. circularis*) in the clothing of long hairs, in its larger size, different shape of the sternum, etc.

DISCOPOMA, sp.

One specimen from Flagstaff, July 4, with a species of *Lasius*. It is dark-colored, plainly longer than broad, and with some short hairs in front.

EXPLANATION OF PLATE VII.

- FIG. 1. *Protolophus tuberculatus*, palpus of female.
2. *Marpissa albopilosa*, dorsal view.
3. *Marpissa albopilosa*, vulva.
4. *Drasius coloradensis*, vulva.
5. *Oxyopes compacta*, palpus.
6. *Oxyopes compacta*, vulva.
7. *Prosthesina barberi*, vulva of small specimen.
8. *Discopoma hirsuta*, ventral view.
9. *Marpissa albopilosa*, leg I.
10. *Trochosa parva*, vulva.
11. *Prosthesina barberi*, vulva of large specimen.



SOME ARIZONA SPIDERS.

FOR EXPLANATION OF PLATE SEE PAGE 221.

SMITHSONIAN INSTITUTION.
UNITED STATES NATIONAL MUSEUM.

DESCRIPTIONS OF THE LARVÆ OF SOME
MOTHS FROM COLORADO.

BY

HARRISON G. DYAR,
Custodian of Lepidoptera.

From the Proceedings of the United States National Museum, Vol. XXV, pages 389-412.

[No. 1290.]



WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1902.

DESCRIPTIONS OF THE LARVÆ OF SOME MOTHS FROM COLORADO.

By HARRISON G. DYAR,
Custodian of Lepidoptera.

With the sanction of the Secretary of the Smithsonian Institution, I spent three months in Colorado in the summer of 1901, to investigate the life histories of some of the moths of that region. As Colorado embraces several different faunal regions, and as the arid condition of the country renders the fauna very sparse and sporadic, different conditions are found to obtain there than in the Atlantic region in the matter of collecting. It was found impossible to move about so as to cover various faunal regions without losing the larvæ already collected in one place, owing to the impracticability of keeping a fresh supply of food plants. I located in Denver and collected mainly on the prairies and foothills within 20 miles of that place. Mr. A. N. Caudell, of the Department of Agriculture, accompanied me, and was allowed to assist me by the permission of the entomologist of that Department.

The species of Lepidoptera occurring in Colorado indicate four faunal regions in the State. (1) The prairie fauna occupies all the flat land from the bases of the foothills eastward, probably including the eastern third of the State and reaching to Texas. It is composed largely of species peculiar to the region. The very dry condition of this land and the sparse vegetation, mostly disappearing early in the season, with the absence of trees, renders this condition necessary. (2) The fauna of the foothills occupies the hilly and uneven land from the bases of the mountains up to timber line. The line of division between this fauna and that of the prairie is very marked. The foothills rise quite sharply from the plains, and within a few paces, almost, the change in the fauna is observable. The foothills have a few trees, pine, and other evergreens, with a dwarf oak, all sparsely distributed; a hardy bush, *Cercocarpus parvifolius*, seems to prefer the most unfavorable hill tops. In the bottoms of the canyons, where water persists, cottonwood, willow, and other trees occur, often densely, which permits the occurrence of many species belonging to the Atlantic region

that are absent from the other faunal regions of Colorado. I did not notice any essential change in the fauna with altitude, from the base of the foothills (5,000 feet) to timber line (12,000 feet). Naturally the individuals were later to emerge in the higher altitudes, but on the whole they were the same species. (3) The Alpine fauna occurs on the high peaks above timber line. It is a small fauna, but entirely distinct from the others. It is essentially that of all mountain peaks, being comparable with the mountain summits of New Hampshire and with Labrador. (4) The fauna of western Colorado occupies the valleys west of the continental divide and doubtless extends to the Sierra Nevada of California and to Mexico. It was impossible to obtain any larvæ from this region, much to my regret. Efforts were made to do so, but proved ineffectual without sacrificing the larvæ that had been collected in the eastern foothills. It is of these latter, with a few from the prairie region, that I have made note.

The following is only a partial list of species observed. Those of which the larvæ did not come under observation, even though the moths were collected, are not mentioned. Besides the 69 species here noted, I have given full life histories of 10 species of Geometridæ in "Psyche," descriptions of the larvæ of 3 species of *Depressaria* in Mr. Aug. Busck's paper on that genus, 5 species of *Gelechia* in Mr. Busck's article on the Gelechiidæ, and of *Triplocris smithsonianus* in the Proceedings of the Entomological Society of Washington. A number of species were noted but not bred, and there remain several not yet satisfactorily determined, to which I shall revert when the opportunity offers.

LIST OF SPECIES.

<i>Hemileuca maia</i> Drury.	<i>Syneda hastingii</i> Henry Edwards.
<i>Hemileuca nevadensis</i> Stretch.	<i>Allypia maceulochii</i> Kirby.
<i>Pseudoluzia shastucensis</i> Behrens.	<i>Malacosoma tigris</i> Dyar.
<i>Apantesis superba</i> Stretch.	<i>Eudule unicolor</i> Robinson.
<i>Apantesis figurata</i> Drury.	<i>Hydrionene trifasciata</i> Borkhausen.
<i>Leptacraea californiae</i> Walker.	<i>Sciagraphia perrolata</i> Hulst.
<i>Leucacraea acerua</i> Drury.	<i>Dianthetis occidentaria</i> Packard.
<i>Eubaphe aurantiaca</i> Huebner.	<i>Aleis haydenata</i> Packard.
<i>Habidota maculata</i> Harris.	<i>Encamera jutrarnaria</i> Guenée.
var. <i>alni</i> Henry Edwards.	<i>Epiplatymetra coloradaria</i> Grote and Robinson.
<i>Heliothis phlogophagus</i> (Grote and Robinson).	<i>Odonotosia elegans</i> Strecker.
<i>Caradrina extima</i> Walker.	<i>Pheosia dimidiata</i> Herrich-Schaeffer.
<i>Leucania fardu</i> Grote.	<i>Tortricidia testaceus</i> Packard.
<i>Stretchia plusiiformis</i> Henry Edwards.	var. <i>crypta</i> Dyar.
<i>Xylina torrida</i> Smith.	<i>Melitara junctolineella</i> Hulst.
<i>Xylomiges simplex</i> Walker.	<i>Acrobasis betulella</i> Hulst.
<i>Thyreion rosea</i> Smith.	<i>Pionea belialis</i> Druce.
<i>Oncullia laticornis</i> Lintner.	<i>Oryptilus delawarensis</i> Zeller.
<i>Ipiomorphia pleonectum</i> Grote.	<i>Pterophorus sulpharodactylus</i> Packard.
<i>Cissura valens</i> Henry Edwards.	<i>Platyptilius cosmodactylus</i> Huebner.
<i>Syngrapha howlandii</i> Grote.	

Alucita cinerascens Walsingham.
Teras foliana Walsingham.
Cucæcia argyropsila Walker.
 var. *viridana* Dyar.
Cucæcia semiferana Walker.
Cucæcia negundana Dyar.
Cucæcia cerusivora Fitch.
Cucæcia rosareana Harris.
Lophoderus coloradana Fernald.
Cenopsis directana Walker.
Platynota labiosa Zeller.
Orchemnia dianæ Hübner.
 var. *betuliperda* Dyar.
Cerostoma rubrella Dyar.
Gnorimoschema cognatella Busck.
Anacamptis innocella Zeller.

Neolyda bifidella Dietz.
Gelechia ribesella Chambers.
Gelechia unctella Zeller.
Gelechia pravinomella Chambers.
Gelechia anarsiella Chambers.
Gelechia versutella Zeller.
Gelechia ocellella Chambers.
Gracilaria pnosodiella Busck.
Gracilaria thermopsella Chambers.
Leucoptera albella Chambers.
Lithariapteryx abroniceella Chambers.
Lithocolletis cincinnatiella Chambers.
Lithocolletis basistrigella Clemens.
Lithocolletis fitchella Clemens.
Lithocolletis sulcifoliella Clemens.
Tischeria cinctipennella Clemens.

FAMILY SATURNIIDÆ.

HEMILEUCA MAIA Drury.

Larva.—Head and feet dark mahogany red in the last stage, black before that; width 4.5 mm. Body black, thickly covered with secondary yellow dots centered by black hair tubercles; subdorsal, lateral, and waved substigmatal lines yellow, broken; incisures reddish. Spines all long, some setæ white; spiracles black, the elevated spots behind them on joints 5 and 11 reddish.

This larva is well known in the Atlantic coast region from Massachusetts to Florida and has been often described. The young larvae were found gregariously on the oak on May 20, in a gulch leading up from the Platte Canyon. They were matured about the 1st of July. No moths were bred, but I can not doubt the identification, as the larva is very familiar to me.

HEMILEUCA NEVADENSIS Stretch.

Larva.—Head, plates, and feet very bright mahogany red; width 4.5 mm. Body with the yellow spots confluent all over the dorsal and lateral spaces, making the ground color yellow except narrowly subdorsally and ventrally. Spines of the upper row all bright brown, the long ones with black shafts.

This larva is well known in the Pacific coast region and through the arid West, and has been described in all its stages. Several were found on willow near Denver by a water course in the prairie, and were matured about the 1st of July. A moth emerged in September.

The occurrence of these two species within a few miles of each other, but in different faunal regions, is interesting, both as illustrating that they are different species though so similar, and how the Atlantic coast fauna is interpolated in the middle of the Western one along the foothills of the Rocky Mountains.

PSEUDOHASIS SHASTAENSIS Behrens.

Larva.—Head high, tapering conically, clypeus low, sutures impressed, erect, free, shining black; width 4.5 mm. Body purplish black with faint traces of white lines, the subventral the most distinct; secondary hairs fine, pale, with imperceptible tubercles. Upper row of spines shortened on joints 5 to 12, most of the spinules buff yellow; some buff ones also on the not shortened upper spines of joint 4; other spines black; no white dots on the body.

The larvæ were found, gregarious when young, on rose and wild cherry on the foothills back of Golden. They were matured about the middle of July. *Pseudohasis* occurs all through the West, but there are three forms or species. The one occurring on the eastern foothills is the one with pink ground color in the fore wings that I call *shastaensis*, as proved by examples in Prof. C. P. Gillette's collection.

Family ARCTIIDÆ.

APANTESIS SUPERBA Stretch.

Larva.—Head shining black, labrum yellowish, antennæ pale, pinkish at base; width 3.3 mm. Body black, thoracic feet black, the abdominal ones pinkish, pale. Warts large, normal, arctiform, i and ii with shining bases, i over half as large as ii, which is elongate. Hair abundant, bristly, sparsely barbed, rather short before, long on joints 12 and 13; most of the hair from wart i and a few on the sides of ii are yellow, below this jet black mixed with white, mostly white from warts iv to vi. Warts iii orange, the rest black. A light yellow dorsal line, broken into three spots on each segment, distinct, most of them lanceolate; a line on joints 2 and 3, no shields; joint 2 with little warts, normal.

A variety had the dorsal line nearly obsolete, composed of a few dots; wart iii black like the others. Hairs nearly all yellow, only a few black ones mixed; some longer white ones posteriorly.

Found at Boulder and Golden in the foothills on the ground or feeding on low plants, *Astragalus* and *Lupinus*. The larvæ were very lively and would run for shelter when discovered. They became matured in June, apparently from hibernated larvæ. Moth, July 13. Though not uncommon they were hard to rear, and only one female was obtained. I think, however, that this is the larva of *A. incorrupta*, of which I have only males.

A parasite, *Tachina nella* Walker, was bred from one larva.

APANTESIS FIGURATA Drury.

Larva.—Head shining black, epistoma and bases of antennæ pale; width 2.7 mm. Body brown-black, the abdominal feet pale reddish. A broad, distinct, sharp dorsal line, narrowed between warts i, cream

white, pinkish shaded in the incisures. Warts black, hair bristly, sparsely barbed; i small, less than one-third the size of ii, i with small, ii with large shining base, normal. Hair all black, even the sub-ventral, longer on joints 12 and 13.

One larva found by Mr. E. J. Osler on the foothills, May 12; it fed on alfalfa. The moth that emerged was of the form *f. pallida* Strecker.

LEPTARCTIA CALIFORNIAE Walker.

Egg.—Low conoidal, practically two-thirds spherical, shining pearly flesh color; rather coarsely reticularly shagreened, almost definitely reticulate at the vertex, but the lines broad and confused; diameter 1 mm., height 0.7 mm.

Stage I.—Head bilobed, erect, shining black. Body translucent, faintly yellowish, warts and shields dark brown, thoracic feet black; slight reddish-brown shading about the warts. On thorax warts ia and ib united on a single large plate, single haired; iib small, shortly separated from iia; iv single, vi double, no subprimaries. On abdomen i small, ii on a large plate, iii with two hairs, iv and v single, iv well behind the spiracle, vi absent, but a small, elongate, hairless shield in its place; vii forming a well-developed shield on the leg. Cervical shield with four hairs on each side, three of them black; two other hairs detached on a tiny wart. Joint 13 anteriorly has one wart with four hairs and one with two. The rudimentary tubercle vi is present on joints 5 to 12. Hairs long and fine.

The remaining stages have been fully described by Prof. G. H. French.¹ He found five stages, which my observations do not contradict. Mr. Osler secured me some eggs, and I obtained others from moths taken on the foothills behind Golden, and later I found some larvæ there on the ground or feeding on low plants. The species is not uncommon in the foothills and canyons; I remember it to have been abundant in Williams Canyon near Manitou in 1891.

LEUCARCTIA ACRAEA Drury.

This ubiquitous larva occurred on the prairie and on the foothills as high as Salida, where Mrs. A. N. Caudell collected one. The species seems to despise all natural boundaries and be at home in all fairer regions.

EUBAPHE AURANTIACA Huebner.

Eggs.—Rather low, roundedly conoidal, the base flat and slightly rimmed; shining pale yellow. Reticulations narrowly linear, irregularly hexagonal, not raised, faint. Diameter, 0.6 mm. Turned dull pink.

Stage I.—Head rounded, cordate, pale luteous, shining, broadly

¹ Can. Ent., XXI, 1889, p. 210.

gray shaded over the vertex; eye black. Body normal, arctiiform, pale luteous, warts and shields smoky; hairs dark, long, especially long from joints 5, 6, and 12. Warts i conjoined on the dorsal line into a single pentagonal shield on joints 5 to 11, two separate, elongate, parallel shields on joint 12, single haired; ii single haired, produced forward and downward; iii to v single, normal; vi absent. On the thorax tubercles ia+ib, iia, and iib separate, iib posterior, iv large, vi moderate; no subprimaries. Warts of joint 13 consolidated. Hairs i to iii black, the rest white, spinulose. Cervical shield not converted into warts, divided, notched behind. Feet colorless, long and slender, especially the abdominal ones.

Stage II.—Head bilobed, shining dusky. Body greenish from the food, transparent, shining. Warts small with numerous stiff hairs; i rudimentary, hairless. Hairs dark, spinulose.

Stage III.—Head shining black, bilobed; width about 0.4 mm. Body shining dusky luteous, warts black; i small, paired. Hairs black, moderate, of various lengths, barbed.

Stages IV and V were not described; there was no marked change.

Stage VI.—Head bilobed, arctiiform, black; width 1.4 mm. Body brown, not dark, rather sordid and pale, the lighter-colored warts iii and v orange tinted; a straight dull-orange dorsal line. Warts black; hair black dorsally, pale subventrally, rather bristly, sparse, longer posteriorly. Warts well elevated, round, i small, iv absent, the rest large. All have black hairs at the summit, white ones at the base, but there are more black ones dorsally.

Cocoon a delicate web of silk. Moths emerged August 8, from eggs obtained from moths flying in the foothills June 27.

HALESIDOTA MACULATA Harris, variety **ALNI** Henry Edwards.

This species occurs in three forms in the United States. Those inhabiting the northern Atlantic region and the northern Pacific region, respectively, are indistinguishable in the moth state, though different as larvæ. I have several times received *H. maculata* from Colorado, but never knew to which race to refer the specimens. Mr. Caudell took a larva near Salida and Professor Gillette has in his collection some cast skins. Both show the red dorsal hairs of *alni*, proving the Coloradan form the same as the northern Pacific coast one.

Family NOCTUIDÆ.

HELIOTHIS PHLOGOPHAGUS Grote and Robinson.

Stage V.—Head round, bilobed, black, polished, the vertex under joint 2; epistoma and antennæ white; width about 1.6 mm. Body cylindrical, normal, joint 12 not enlarged but a little angled. Tubercles large, conic, polished black, prominent. Skin spinulose; setæ

large, pale, curved. Black with yellow dorsal line, fine, broken pulverulent; subdorsal line double, running along tubercles i and ii, similar, a little less broken; lateral line broader, broken on the annulet incisures; traces of a line along tubercle iii; stigmatal band broad, including the spiracles and tubercle iv, sharp edged, luteous centered. Feet black. Shields uncornified concolorous, their tubercles black.

Stage VI.—Head green, brownish freckled on the vertex, ocelli black, epistoma whitish; width 2.7 mm. Body cylindrical, normal, shields not cornified. Skin white, granular, spinulose; tubercle iv at center of spiracle or above. Green, traces of a whitish dorsal and subdorsal line; stigmatal band broad, whitish green, white edged below; dorsal line obscure, geminate, blackish filled. Tubercles raised, conic, small, black, white ringed. Feet equal, green. Subdorsal line cuts the cervical shield. Spiracles black rimmed, pale bordered.

Food plant *Grindelia squarrosa*. Found in the Platte Canyon May 30 and collected by Mr. E. J. Osler at Manitou.

CARADRINA EXTIMIA Walker.

Eggs.—Spheroidal, flattened at base, about 40-ribbed, the number diminishing toward the vertex; ribs sharp, narrow, the apices concave, with distinct, curved cross-striæ about as distinct as the lines on the ribs. Vertex hollowed reticulate; yellowish white, stained with an irregular brown ring; diameter, 0.6 mm.; height, 0.4 mm.

Stage I.—Head round, vertex under joint 2, sordid luteous, eye black; width, 0.3 mm. Body cylindrical, thick, joint 12 large dorsally; sordid whitish, the food faintly green; tubercles large, round, black, distinct, normal; ia to iib on the thorax separate, equal, iv on the abdomen behind the spiracle. Shields and leg plates blackish luteous, normal; setæ pale.

Stage II.—Head rounded, blackish; width, 0.5 mm. Body translucent, green from food; cervical shield, anal plate, and the rather large tubercles black. Traces of white dorsal and subdorsal lines; feet pale, those of joints 7 and 8 a little shorter than the others; shields blackish, setæ pale.

Stage IV.—Head dark smoky brown, blackish over the lobes, round, scarcely bilobed, apex slightly under joint 2, but held erect; width, 0.9 mm. Body thick, robust, cylindrical, no enlargements. Dorsum gray brown to spiracles, faintly mottled in pale, forming traces of the usual lines. Below the spiracles sharply paler, slightly pinkish. Tubercles rounded, elevated, blackish, normal, iv at the top of the spiracle. Feet and leg shields smoky blackish. Setæ rather long, pale, curved.

Stage V.—Head dark smoky brown, clypeus paler, sordid; held erect, slightly retracted; width, 1.2 mm. Body sordid brown, mot-

tled, subdorsal line diffuse above, obscurely pale. Color paling ventrally but not sharply. Tubercles black. Very obscurely colored and without defined marks.

Stage VI.—The same, pale, obscurely marked. Dorsal space broadly paler mottled, all sordid brown. I have previously described this stage.¹ Width of head 1.8 mm.

Eggs from a female moth taken at Denver, June 23. Moths issued from these larvæ August 13. The larvæ fed readily on *Polygonum*; probably they would eat any low plants.

LEUCANIA FARCTA Grote.

Eggs.—Spheroidal, distinctly flattened above and below, about alike at the ends, somewhat irregularly shaped from pressure as they were laid in a crevice, glued to both sides but weakly. Shining pale yellow. Reticulations finely linear on a smooth surface, irregularly 4 to 6 sided; no trace of ribs. Flattened sides smooth, somewhat plainly rimmed; diameter 0.6 mm.

Stage I.—Head round, luteous, ocelli large, black; width 0.3 mm. Body cylindrical, joint 12 enlarged dorsally, joints 5 and 6 enlarged; semilooping, but the feet of joints 7 and 8 only a little smaller than the others; segments rather roughly 8 to 4 annulate, especially on thorax. Whitish translucent; cervical shield small, brownish; food faintly yellowish, no marks. Tubercles and setæ obsolescent and scarcely visible. Thoracic feet brownish at tip; no leg shields nor anal plate; setæ pale.

Stage II.—Head rounded, slightly bilobed, erect, antennæ rather large; translucent testaceous, dark on the vertex from within, ocelli black, mouth brown; width 0.5 mm. Body cylindrical, rather larger behind the thorax and at joint 12. Dull gray-green dorsally, whitish ventrally with narrow whitish dorsal, subdorsal and lateral lines; the division between the dorsal and ventral colors is sharp. No shields; tubercles small, vi present. Feet pale, normal, practically equal.

Stage III.—Head rounded, bilobed, apex in joint 2; dull luteous; width 0.8 mm. Body smaller behind but subequal, scarcely any enlargements. Finely striped in brown and olivaceous yellowish. Ground pale olivaceous; dorsal line whitish, brown edged; subdorsal line whiter, brown edged, very distinctly so below; below this a yellowish white line; lateral line yellowish white, brown edged; stigmatal band white, brown edged, heavily so above; three broken subventral lines; feet and venter pale, scarcely marked. No shields.

Stage IV.—Head held flatly but free from joint 2, luteous, brown reticulate; width 1.4 mm. Body striped in olivaceous yellow and brown. Geminate dorsal, addorsal, broad subgeminate subdorsal lines

¹Proc. Ent. Soc. Wash., IV, 1899, p. 322.

brown; geminate lateral olivaceous filled; broad dark lower lateral and suprastigmatal; substigmatal broad, pale yellow, red filled, folded subventrally. Two weak lines subventrally and faint traces of ventral dark lines. Feet pale, dusky shaded, equal.

Stage V.—Head the same, the reticulations heaviest in a line each side of clypeus and in middle of lobe; width 2 mm. Lines as before, but the lateral is not discolorously filled; all lines red-brown except the broad lower lateral and suprastigmatal which are olivaceous brown.

Stage VI.—Head rounded, scarcely bilobed, erect, free; testaceous, shining, reticulate with dark brown, forming a narrow shaded band edging the paraclypeal pieces, divergent again at the vertex; a less distinct dark line up from the eye; clypeus and median suture broadly pale; tubercles brown; width 3.2 mm. Body cylindrical, normal, not tapering, no enlargements; feet normal, equal. Testaceous, finely strigose lined in red-brown. Dorsal line narrow, pale; a faint, similar line between tubercles i and ii; subdorsal band broad, gray-brown strigose, pale edged above and below, straight; space below red-brown, strigose. Lateral and stigmatal bands broad, gray-brown strigose, contiguous, separated only by the narrow pale edging, the lateral band also edged above in pale, the stigmatal below, this edge being the upper border of the substigmatal band, which is broad, straight, red-brown strigose filled, except at its pale edges. Venter, mottled strigose. Shields undeveloped, concolorous. Tubercles small, black; iv at the upper corner of the spiracle. Spiracles black. Thoracic feet pale, brown tipped; abdominal ones of joints 7 to 10 with smoky blackish shields, excavate above; anal feet reticularly lined.

The moth approaches closely to *L. juncicola* Boisduval and *L. multilinea* Walker, but I have the larvæ of neither to compare. From *L. phragmatidicola* they differ in the color being lighter throughout, the ground testaceous rather than pale brown; the markings are identical in both.

STRETCHIA PLUSIFORMIS Henry Edwards.

Eggs.—Ellipsoidal, scarcely more flat at base than at vertex; nearly 30-ribbed, diminishing by a few toward vertex, the ribs gently waved; cross-striæ fine, indistinctly seen on the sloping sides of the ribs, the vertical reticulation lines on the summits of the ribs not more distinct than the cross-striæ. Micropylar area broadly smooth, finely reticulate. The sculpture reaches a little beyond the lower third of the egg, which is perfectly smooth and shining. Diameter 0.9 mm., height 0.6 mm. Later there appeared a red ring and spot at the summit.

Stage I.—Head rounded, faintly bilobed, full, broad, pale luteous with black ocelli, erect; clypeus narrow, sutures grooved; width about 0.4 mm. Body slender, submoniliform, flattened; feet normal, the two anterior abdominal pair somewhat shortened; joint 12 slightly enlarged. Whitish colorless, translucent, the alimentary canal appear-

ingsordid reddish; shields concolorous, pale luteous, not large. Tubercles small, black, distinct, normal; setae short, pale; feet colorless. The larvæ were quiet and sluggish, remaining hidden all day.

Stage II.—Head rounded, slightly bilobed, larger than joint 2, the lobes full; held obliquely; pale luteous with minute brown dots on the tubercles and a patch on each side of the median suture; antennae and labrum partly pale; width 0.6 mm. Body cylindrical, normal, joint 12 slightly enlarged; feet normal, but those of joints 7 and 8 slightly reduced. Sordid whitish, shields concolorous, scarcely cornified; narrow white dorsal and subdorsal lines, a broader stigmatal one, irregular and blotched. Tubercles neatly black; feet pale; setae moderate.

Stage III.—Head rounded, polished orange, the clypeus and sutures more yellowish, mouth brown, ocelli black; width 1 mm. Body cylindrical, noctuiform, joint 12 enlarged, joints 3 to 6 arched in rest. Green, sordid, subtranslucent; neat, narrow, white dorsal and subdorsal lines; a broad white substigmatal band inclosing tubercles iv and v and the spiracle. Feet normal, equal. Tubercles neat, round, moderate, with the spiracles black, the latter narrowly ringed. Shields concolorous, the cervical shield polished. Feet all pale, the abdominal ones with the tubercles vii black. A brown form of the larva also occurred. All shaded with dilute black between the lines; stigmatal band slightly yellowish; feet pale but sordid tinted; head as in the green form.

Stage IV.—Head rounded, the vertex slightly under joint 2, shining brown, mottled with darker; width 1.5 mm. Body thickly mottled with chocolate brown on a whitish ground, the dorsal space lighter by the ground showing more distinctly. Fine dorsal and subdorsal white lines somewhat dotted and broken; stigmatal line broad, sharply edged, narrowed in the incisures, white edged, broadly dull red and luteous filled, including tubercles iv and v and the spiracles which are white, narrowly black rimmed. Tubercle iv at center of spiracle, or above on joints 9 and 10. Venter paler; feet pale; tubercles in rather large black spots. Shields concolorous.

Stage V. (Interpolated).—One larva had this stage with markings as in the previous one. Width of head 1.8 mm.

Stage VI. (Normal ♀).—Head rounded, the apex under joint 2, shining pale brown, reticulated with dark, a dark patch on each side of the clypeus; width 2.3 mm. Cervical shield shining brown, a darker spot before and on the anterior angle, produced backward into a lateral border; dorsal and subdorsal lines faint, pale. Body robust, joint 12 enlarged, joint 13 somewhat perpendicularly truncate, its foot nearly under the hump of joint 12; thorax a little smaller than abdomen. Brown mottled, chocolate on a light yellowish ground. Dorsal line of new white dots in the center of the segments, edged by a dark cloud; subdorsal line similar, more continuous; lateral space heavily dark

shaded; stigmatal band brown, of the ground color, filled with light brown and reddish mottlings, not contrasted; subventral space but a shade darker, mottled. Tubercles in small brown spots; feet pale. Tubercle iv above the center of the spiracle on joints 9 and 10. Posterior parts of subdorsal space segmentarily paler, forming a transverse band of pale on the hump on joint 12. Spiracles black ringed.

Eggs from a moth captured in Denver. The food plant is the wild currant. Eggs May 12, mature larvæ June 24.

The larva of this somewhat striking moth proves to be a very plainly colored, day hiding Noctuid.

XYLINA TORRIDA Smith.

Larva.—Head rounded, not bilobed, erect, green, epistoma and bases of antennæ white; width 3 mm. Body normal, joint 12 not enlarged, joint 13 tapering; robust, cylindrical. Clear green; a straight, white dorsal line on joints 3 to 13, granular shagreened; tubercles small, white; skin minutely white peppered. Subdorsal line narrow, broken, granular, white; traces of a similar lateral line; substigmatal line narrow, granular, pale yellow, from joint 2 to the anal plate. Feet green; spiracles white, finely black rimmed. Tubercle iv at the lower corner of the spiracle. Cervical shield green; anal feet shortly extended backward, white lined. Later there is a white dorsal shade, the stigmatal line is yellow, the subdorsal one obscure.

Pupation in the ground. Larva found on wild cherry in the Platte Canyon May 21; imago emerged September 25.

XYLOMIGES SIMPLEX Walker.

Stage III.—Head rounded, black; width 0.9 mm. Cervical shield quadrate, black; body rather thick, cylindrical, noctuiform, joint 12 scarcely enlarged, very sordid whitish, almost gray, with narrow white dorsal and subdorsal lines, the latter edging the cervical shield; fainter lines along tubercles iv and v. Tubercles round, slightly elevated, black, distinct, normal. Leg plates and anal plate black; feet black; setæ dusky, short; tubercles faintly pale ringed.

Stage IV.—Head shining black, epistoma and bases of antennæ sordid white; width 1.6 mm. Cervical shield black, trisected in white narrowly. Body purplish black, pale mottled; dorsal and subdorsal lines white, discreet, broken; stigmatal band yellowish, luteous centered, including the spiracle and reaching to tubercle v, sharp edged. Tubercles black, rounded, elevated, polished. Setæ rather long, pale. Venter sordid greenish, purplish shadowed.

In stages V and VI the head became red brown, but as I have already described these stages¹ I will not transcribe my notes. The larvæ occurred hiding in spun leaves on wild plum in the Platte Canyon and

¹Can. Ent., XXVI, 1894, p. 21.

on various plants at Sedalia. No moths were bred, but the larvæ are obviously the same as those formerly bred by me, and *Xylomiges simplex* is native to the region, for I took it abundantly at Manitou in May, 1891.

THYREION ROSEA Smith.

Eggs.—Hemispherical, the base flat, about 28 vertical ribs, low, rounded, diminishing regularly by alternation at the upper three-fourths and ending at the micropyle, forming a slightly depressed ring; vertex again a little elevated, reticulate. Cross-striae faint, but the cell areas slightly hollowed, a row on each side of each ridge, the joinings in the hollows and on vertices of ridges which appear somewhat beaded; color pearly white; diameter 0.8, height 0.4 mm.

Stage I.—Head rounded bilobed, mouth pointed, shining black; width 0.4 mm. Cervical shield black, excised at the posterior angles and a little so on the dorsal line posteriorly; anal plate faintly dark tinted. Body normal, white, no marks. Tubercles very small, with moderate, pointed setæ, black. Thoracic feet blackish ringed, abdominal ones normal, equal, pale. On hatching the larvæ entered completely within the leaves of the food plant, where they burrowed between the epidermes.

Stage II.—Head rounded, brown black; width 0.6 mm. Cervical shield and plates dark brown; body all white, immaculate, the small tubercles dark.

Stage III.—Head pale yellowish luteous, sutures, area about eyes and jaws broadly brown; width 0.9 mm. Body all whitish, cervical shield a little shining and a shade yellower, but practically concolorous. Tubercles minute, setæ moderate, dark. Feet normal; spiracles black ringed, rather round.

Stage IV.—Head round, bilobed, compact, and smooth, vertex level, clypeus rather high, nearly reaching the membranous triangle, showing dark brown; sutures and rims of lobes posteriorly blackish; width 1.2 mm. Cervical shield large, the posterior angles rounded, scarcely notched behind, shining light brown, with two detached setæ on the lower side not on a shield. Anal plate shining brown, with dark tubercles. Body all opaquely white, the tubercles small, brown, with short, stiff, dark setæ. Spiracles brown rimmed. Feet normal, the crochets in a neat half circle on the inner side of the planta. Tubercle iv at lower corner of spiracle.

Stages V and VI were not obtained. The larvæ feed at first internally in the leaves of the wild onion, *Allium* sp.; Mr. Osler tells me that he has seen them devour the whole plant, eating down into the bulb. The moth flies at the time the plants are in blossom and rests on the flowers, where it is inconspicuous, its pink and whitish colors harmonizing with those of the blossoms. Found on the prairie near Denver, May 29.

CUCULLIA LAETIFICA Lintner.

Larva.—Head rounded, bilobed, erect, free; white, sutures of clypeus, a broad band from antenna to above clypeus joined by dottings to another band covering the backs of the lobes and sides black; width 3.2 mm. Body greenish white with diffuse, clouded, dorsal, subdorsal (fainter), and stigmatal yellowish bands; curiously black banded. Three irregular transverse bands on each segment; one across tubercles i and ii, widened there, joined by an anteriorly situated dorsal bar, rounded furcate laterally; an irregular dark anterior band and a broken posterior one, enlarged into a subdorsal spot. Irregular black markings subventrally and on the feet; tubercle vi in a white space. Feet normal, equal; thoracic ones black marked; tubercle iv at the lower corner of spiracle or below. In some examples the black is joined in a subdorsal line.

Larvæ at Golden and Sedalia on the prairie near the base of the foothills on a low tufted species of *Chrysothamnus*. Found early in June in the last four larval stages, no marked difference except in size. These handsome larvæ resemble those of a *Papilio* of the *asterius* group to a remarkable degree. Pupation in the earth in a rather firm cell of considerable size, lined with silk. First imagos July 5.

IPIMORPHA PLEONECTUSA Grote.

Larva.—Head broad, slightly bilobed, flat before, white with a broad black band on the angle on each side, irregularly edged, meeting vertically except for the suture; epistoma surrounded by brown; width about 3 mm. Body light green, translucent, densely minutely clear granular. A white dorsal stripe and a narrower broken subdorsal one; substigmatal line white, narrow; all the lines reaching from joint 2 to the anal feet, but the green shield only faintly white lined. Tubercles i and ii white, the rest green, obscure; spiracles flesh colored, dark rimmed; claspers whitish.

The larva was found hiding in a folded leaf made by a Tineid on the cottonwood in Denver. It hid most persistently, and was disturbed on being forcibly exposed. Mature larva early in June; imago July 10.

CISSURA VALENS Henry Edwards.

Stage IV.—Head round, full above, oblique, the apex almost under joint 2, dark gray, heavily mottled reticulate with black on a white ground, leaving a conspicuous white speck on the face of each lobe; width 1.5 mm. Body slender, elongate, the feet on joints 7 and 8 much smaller than the others. Whitish gray, silky, shining; dorsal and addorsal lines gray, dotted powdery; addorsal line straight, widened centrally on the segments; subdorsal line black, waved, bending upward in the incisures. Lateral, suprastigmatal and two subventral lines gray, dotted, confused, subgeminatæ. Thoracic feet

black tipped, abdominal ones gray dotted. Tubercles in small black spots, ii of joints 12 and 13 larger.

Stage V.—As before, but the ground color pale brown, the reticulations black, the conspicuous fleck white; width 2.8 to 3.1 mm. Dorsal space bordered by the nearly black waved subdorsal band, the gray area above it segmentarily divided, filled centrally with dark dotted mottlings on a pale gray ground. Sides pale gray dotted, a dark band over the spiracles, and subventrally formed by the dottings being darker. Setæ long, pale; spiracles dark. The shape is slender, narrowing a little on joints 10 to 13; anal feet rather large, the rest moderate, those of 7 and 8 smaller. Joint 12 very little enlarged. Shields concolorous.

Stage VI.—Head rounded, bilobed, the apex under joint 2; brown, heavily reticulate with black especially in a long transverse patch over the eye; epistoma and basal antennal joint wax white; width 3.7 mm. Body elongate, joint 13 tapering, cylindrical; feet short, pale. Brown, shaded with gray and black. Dorsal space waved, narrowed in the incisures; a broken, mottled, dorsal band and a distinct subdorsal one, irregular about tubercle i, composed of black mottlings on gray, filled between with red dotting on white. A broad, pale lateral space like the dorsal one, narrowly centered with blacker dottings. A black stigmatal band like the subdorsal one, diluted centrally; substigmatal band again pale like the dorsal filling, the subventral area dark, but not so dark as the dorsal marks. Tubercles, i to iv obscure, iv at the upper angle of the spiracle; v and vi large, black. Leg shields whitish, spiracles black; setæ rather long and pale. The subdorsal and lateral black bands join posteriorly on joints 12-13, making the anal flap all black. On joint 11 a little white dash at tubercle ii and before spiracle.

Pupation in the ground. Larvæ from Platte Canyon and Sedalia in the foot hills, June 1 to 20, the imago the following March.

Food plant—Oak, young leaves.

SYNEDA HOWLANDII Grote.

Eggs.—Spheroidal, the base slightly flattened, all slightly shining yellowish white, subtranslucent; coarsely pitted, the pits in vertical lines becoming less in number vertically by confluence, rounded, subangular, well defined; the spaces between are broad and too much rounded to look like reticulations. No ribs, the cross ridges as distinct as the vertical ones and like them; irregularly hexagonal. Diameter, 0.9 mm.

Stage I.—Head rounded, oblique, pale brownish with black ocelli and brownish line from them backward; width 0.4 mm. Body sordid whitish, the food green; a diffuse brown lateral band between warts iii and iv indistinctly composed of three lines. Shape elongate,

slender, feet on joints 9, 10, and 13, those of 9 and 10 approximate. Tubercles small, black; setæ pointed. Cervical shield concolorous with head; thoracic feet brownish, abdominal ones with dusky plates. After eating, the marks became faint and the larva looked sordid green.

Stage II.—Head rounded, oblique, the lobes bulging; whitish, with three brown bands on each lobe, the upper obliquely clouded, the lower, behind the black ocellus, narrow; with 0.6 mm. Body slender, feet on joints 9 and 10 (approximate) and 13, with minute stubs of feet on joints 7 and 8. Dorsal space greenish white, slightly streaked with traces of dorsal and addorsal lines. Subdorsal, lateral and broad suprastigmatal brown lines on a whitish ground; substigmatal band whitish; two subventral brown bands. Setæ stiff, dark, rather long from very small black tubercles. Thoracic feet black; abdominal ones brown lined. Joint 12 very little humped.

Stage III.—Head white with three geminate lines on each lobe, parallel to those of the body, the upper one abbreviated; width 1 mm. Body slender as before, whitish, subdorsal line double, fine, purplish black, the upper part narrow, waved; three fine lines above the white substigmatal band; three partly confluent and irregular reddish subventral lines and a dotted ventral one. Setæ distinct, dark, but tubercles obsolescent.

Stage IV (Interpolated).—As in the next stage; width of head 1.3 mm.

Stage IV (Normal).—Head white with three geminate, purplish black crinkly bands, reaching from the back of the lobe to the clypeus, pointed at the lower end; an erect mark over epistoma to apex of clypeus; sutures narrowly dark. Shape round, full above, slightly bilobed, larger than joint 2 but the apex a little covered by it, rather pointed at the mouth; setæ dark; width 1.5 mm. Body uniform, slender, the feet of joints 7 and 8 very small rudiments, those of 9 and 10 distinct, approximate, of 13 stretched posteriorly. Gray-white, traces of a dark dorsal line; subdorsal line double, the upper part waved, the lower crossing tubercles i and ii, linear, purple black; a faint single lateral line; suprastigmatal line double like the subdorsal one but straight, the upper part crossing tubercle iii, the lower iv; stigmatal band slightly more white than the ground; three subventral lines a little crinkled and irregular, especially the central one; venter gray-white, a half shade lighter than the dorsum. Feet pale, brown marked. Segments slightly wrinkly annulate especially posteriorly. Tubercles small, black; setæ black, distinct posteriorly.

Stage V.—Head rounded, scarcely bilobed, oblique, large at vertex, higher and wider than joint 2 but the apex retracted; whitish, three geminate gray brown dotted filled bands on each lobe and an erect mark in the clypeus; width 2.3 mm. Body gray, dotted banded. Dorsum brownish dotted filled, spaced by pale from the broad black

dotted, waved subdorsal band; sides very pale dotted filled, pale spaced; suprastigmatal band geminate, nearly black, dotted filled; substigmatal band white, shrunk by the fold, reddish filled. Below it a geminate, sparsely dotted filled reddish line, single subventral line and the pale venter sparsely dotted. The larva gradually tapers posteriorly, joint 13 being the smallest; slender, uniform. Tubercles a little elevated, white, black marked, iv at the middle of the spiracle. Central segments elongated; feet as before.

Stage VI.—Head large, round and full, wider and higher than joint 2 yet the apex retracted in the expanded end of the prothorax; median suture a little depressed, clypeus small. White, mouth a little luteous; an erect black dash in clypeus; three broad bands on each lobe from the occiput converging to the clypeus, black edged, filled with black and brown dots; width over 3 mm. Body slender, cylindrical, elongate; feet on joints 9, 10, and 13, with little rudiments on joints 7 and 8. Broad gray black subdorsal and stigmatal bands, sharply edged, black dotted filled. Dorsal space brown, thickly dotted on an ashy ground; a white speck at tubercle ii before, while the blackish subdorsal band is diluted with brown: lateral space pale ashen, finely dotted in dull red; a pale speck at tubercle iv; substigmatal band like the lateral space; venter sparsely dotted in blackish, illy defining a subventral band, colored like the substigmatal one. Tubercles dark gray, setæ small, dark. Tubercle iv at the lower edge of the spiracle.

Eggs from a moth flying over the foothills at Platte Canyon. The larvæ fed on *Eriogonum*.

SYNEDA HASTINGSII Henry Edwards.

Eggs.—Nearly spherical, a little flattened on the base, very slightly conoidal. Smooth, shining, dull yellow with a greenish olivaceous tint. No reticulations or ribs, the surface covered with slight, shallow depressions, their edges illy defined; diameter 0.8 mm.

Stage I.—Head rounded, oblique, luteous, diffusely brown streaked, scarcely bilobed; clypeus high, ocelli small, black; width 0.4 mm. Body long and slender, motion semilooping, the larvæ thrashing about violently before progressing. Slender, uniform, feet on joints 9, 10, and 13, rather long and well developed. Whitish, green from the food, a faint broad and clouded lateral vinous band. Tubercles very small, black, obscure. Cervical shield brownish, not cornified; feet, except the anal ones, black. Later the lateral shade resolves itself into three distinct lines—subdorsal, lateral, and suprastigmatal. There is a white substigmatal band and faint brown line subventrally; dorsal space whitish.

Stage II.—Head rounded, oblique, the apex under joint 2, full and smooth, the sutures not depressed, clypeus small; whitish, three dotted brown bands on each lobe and a faint linear streak dividing the clypeus

and epistoma. Body long, slender, feet on joints 9, 10, and 13, those of 9 smaller and approximate to 10, a pair of minute stubs on joints 7 and 8. Greenish white, a luteous streak dorsally, divided into segmental dashes swollen centrally; subdorsal line brown, diffuse, black dotted by tubercles i and ii; lateral, suprastigmatal, and two subventral brown lines, not very sharply defined. Thoracic feet black, the abdominal ones dusky. Tubercles round, dark brown, setæ short, stiff, pointed, black. Central segments drawn out, the end ones contracted.

Stage III.—Head as before, the three dotted bands geminate, yellowish white filled; erect brown mark over epistoma does not reach top of clypeus; width 1 mm. Body slender; dorsal line greenish white, widened segmentarily, black dotted edged, centered by a black dotted line broken in the incisures; space to the narrow brown subdorsal (i–ii) line gray; a single lateral, double gray-filled suprastigmatal and substigmatal (between iv and v) lines, the latter white; double subventral and single, somewhat shaded ventral brown lines. Thoracic feet black; abdominal ones brown lined.

Stage IV.—Head shaped as in *Syneda howlandii*, white, striped the same, the three dotted irregular bands on each lobe reddish brown; erect mark in clypeus; width 1.4 mm. Body slender, whitish, gray tinted. Dorsal line single reddish; subdorsal line geminate, purplish brown, dotted, irregular, waved, dark gray shaded segmentarily behind tubercle ii; two lateral and stigmatal dark dotted lines; three fainter subventral ones leaving the substigmatal band a little paler than the ground color. Tubercles in black spots, setæ black.

Stage V.—Head large, full above, higher and wider than joint 2, slightly oblique, the apex retracted; white, three dotted geminate black bands on each lobe narrowed before; an erect mark in clypeus blackish. Gray white, the single dorsal line reddish and widened on joint 2 anteriorly; subdorsal line double, dotted filled, gray shaded behind tubercle ii; lateral line single, suprastigmatal double, obscurely dotted filled; substigmatal band whiter than the ground color; three or four fainter dotted dark lines subventrally, reddish brown. Feet brown dotted, the shape as before.

Stage VI.—The same, but the lines more dotted filled; also the spaces filled in more with reddish dots; width of head 2.3 mm.

I am not sure that this larva is different from that of *Syneda howlandii*. I have given the notes on both somewhat at length, but the lines are all the same and the apparent differences may be due to different wording and to slight variations in the larvæ under observation. The larva of *S. hastingii* did not grow vigorously in the latter stages, as the widths of head show, and was somewhat undersized, possibly with the markings a little undeveloped. It fed on the same species of *Eriogonum* as the other larva.

Eggs from several moths caught flying at Denver and in the foothills.

Family AGARISTIDÆ.

ALYPYA MACCULLOCHII Kirby.

Larva.—Head rounded, bilobed, erect, white, thickly covered with rather large black spots and a few small ones; a yellow shade over vertices of lobes and at bases of antennæ. Body cylindrical, normal, noctuiform, joint 12 slightly enlarged dorsally. White with broad diffuse yellow shades subdorsally (tubercle ii) and substigmataally (tubercle v), the former becoming deep orange on the hump on joint 12. Tubercles large, black, but round and low, not elevated into cones. Many irregular, confused, crinkled black marks. No white subventral spots whatever, the black markings heavy subventrally; venter less heavily marked. Abdominal feet black at the base, flesh colored outwardly; thoracic feet black. Setæ long, white. The black markings form a series of broken lines and dots, a heavy, geminate, dorsal line, widened a little posteriorly on the segments and with a narrow median spur projecting laterally, more sparsely lined where the yellow color is; sides quite heavily marked; subventral region strongly marked, especially above the feet.

Larvæ on *Uhamænerion angustifolium* resting on the backs of the leaves. Found at the Half-Way House above Manitou, July 21. The larvæ entered the earth to pupate in a few days and the first imago emerged May 4 the following season.

Family LASIOCAMPIDÆ.

MALACOSOMA TIGRIS Dyar¹

Eggs.—Laid in a patch half as long as wide reaching halfway or all around a small twig. Elliptical, flattened on two sides, the larger end squarely truncate, rimmed, the nearly circular center raised; small end rounded. Laid erect on the small end, fastened together by gum, but the exposed ends clear of any varnish; the mass looks white and the spaces between the eggs are visible. Sordid white, a dark micropylar dot. Surface smooth, slightly shining, scarcely shagreened. Size 1 by 0.6 by 0.5 mm.

The egg masses were found on the lower twigs of the food plant, often very near the ground. Exactly similar egg masses were sent to the Department of Agriculture from Jonesboro, Coryell County, Texas, which hatched on April 5. *M. tigris* was then undiscovered and I could not imagine what these eggs were. A memorandum of the food plant was not sent me and the larvæ refused the plants that I offered them. This locality is somewhat distant from the place where I discovered the species; however, I insert my notes on the first stage of the Texan larvæ, as I believe that they are of the same species.

¹Proc. Ent. Soc. Wash., V, Mar., 1902, p. 38.

Stage I.—Head rounded elliptical, higher than wide, black, epistoma white; setæ long, pale, secondary; width about 0.35 mm. Body normal, black, the anterior edges of the joints pale; a pale-orange subdorsal band on joints 5 to 11, fading out at the ends, sharp above, diffuse below and spreading laterally on the anterior and posterior parts of the segments, most so posteriorly. Subventral fold white. Warts small but elevated, black with small tufts of pale, rather stiff hairs.

Stage II not seen. The following stages are from the Colorado larvæ:

Stage III.—As in the next stage, but the bands more diffuse and paler colored; no blue markings. Width of head 0.7 mm.

Stage IV.—Head round, black, with pale secondary hairs; width 1.2 mm. Body normal for *Malacosoma*; a broad, geminate dorsal band, orange red, widened three times on each segment, most so posteriorly, extending on joints 4 to 11, faintly also on joint 3, suddenly absent on joint 12; a narrow, waved, cream-colored subdorsal line, absent at the ends; more orange markings laterally with traces of blue dottings between these; a blotched pale orange stigmatal band; subventral folds grayish. Ground color black, velvety on joint 12 and in the incisures of joints 2-3 and 3-4. Hairs rather sparse, of various lengths, faintly reddish, alike.

Stage V.—Width of head 1.8 mm. Much as before, but the lateral stripe is fine and broken and the subventral ones practically obsolete. There is more blue; a dot posteriorly above the subdorsal line, a large patch between that and the lateral line, subventral region blue-gray shaded, joints 12 and 13 blue streaked. Hair reddish dorsally, pale reddish subventrally. Subdorsal line forming a dot on the posterior edges of the segments. Posterior edges of segments yellowish.

Stage VI.—Head rounded, erect, the clypeus small, the paraclypeal pieces forming a shield-shaped area above the clypeus; velvety black, blue powdered, especially along the sutures; many secondary hairs; width, 3.7 mm. Body cylindrical, normal, joint 13 smaller; flaccid; warts obsolete, the hair subtufted dorsally and subventrally anteriorly on the segments, short, rather scant. Velvety black; dorsal line geminate, irregular, mottled, orange, inclosing reddish dorsal hair, widening and divergent posteriorly on the segments, moderately distinct, especially on joint 11, absent on joint 12. Subdorsal line distinct, irregular, broken in the segmental incisures, orange, absent on joints 12 and 13; traces of a lateral and a substigmatal line, orange, the lateral fairly distinct and followed below by orange tinted, white, subventral spots; joint 2 nearly all black. Blue transverse dashes in the subdorsal space, a short anterior and long posterior dash in the lateral space, the latter cutting the lateral line and reaching to the subventral space. On joints 3 and 4 this dash is very marked, curved, edging a

deep black space. Pale reddish or fleshy mottlings posteriorly on the segments in the incisures. The slight subdorsal warts on joint 2 black. A few black hairs dorsally from the obsolete warts i. Traces of a white dorsal line on joints 3 and 4.

Cocoon, as usual, of pale-yellow silk. Larvæ first seen in Mill Gulch, leading out from the Platte Canyon, later farther down the canyon, but not common. At Sedalia, however, they occurred numerously, and had defoliated acres of their food plant. Feeding on the oak, a dwarf tree in this vicinity, but only on the young leaves. Gregarious at first, as usual, but later wandering widely as the young tender leaves become scarce. The larvæ form no tent, but spin a slight web over the branches, which becomes a rather distinct mat at the times of moulting.

This species is nearest to the Californian *M. constricta* Stretch, but quite distinct in the character of the egg covering, which, in that species, consists of a great mass of white, frothy varnish.

Family GEOMETRIDÆ.

EUDULE UNICOLOR Robinson.

Eggs.—Elliptical, evenly rounded, one diameter less than the other, but no flattenings nor truncation; neither end perceptibly depressed. Pale ochraceous, the surface faintly reticulate in whitish, the lines broad, rounded, rather regular, a color, and not any perceptible structure; surface very finely and uniformly granularly shagreened. Skin very delicate, dents in when breathed upon and then flattens out again. Size 0.8 by 0.7 by 0.6 mm. Laid adherent, without threads. The eggs vary in size, some being but half the bulk of others though laid by the same female. Later the eggs turned orange color.

Stage I.—Head rounded bilobed, flat before and rather thin, erect, black. Body slender, greatly elongated, the segments slightly swollen subventrally. Thoracic feet distinct, approximate; abdominal ones small, normal, situated on joints 10 and 13. All pale yellowish, the thoracic feet gray tinted; faint subventral brownish segmentary spots. Tubercles small, black; setæ short, dusky, slightly enlarged at tip. Anal feet with oval blackish shields and a pair of similar convergent shields on the anal flap. A faint, subquadrate, luteous shield subdorsally on joint 2. Setæ of joints 6 to 13 directed obliquely backward, those of joints 2 to 5, obliquely forward.

Stage II.—Head rounded, bilobed, erect, free; dull brown, blotched with darker in the sutures and sides of lobes; width about 0.5 mm. Body slender, elongate, feet normal, approximate at its extremities. Pale brownish, greenish from the food; a broad blotched, partly faint subdorsal brown band; a round dark-brown blotch on tubercle iv on joints 5 to 9 and more faintly on joint 10; tracheal line whitish.

Segments finely obscurely annulate; setæ short, stiff, black; no shields.

The larvæ were not carried to maturity. The eggs came from a female taken in the mouth of Platte Canyon in the foothills, and their food plant was made out so late that they had been four days without food and were so weakened that they died in the second stage. The food plant is violet, but it was only after repeated efforts that this was discovered and a whole day spent in a special journey to the spot where the moth had been caught.

HYDRIOMENE TRIFASCIATA Borkhausen.

Larva.—Head rounded, free, light brown, sparsely mottled, dotted with dark; tubercles darker, as are the sutures and eyes; width about 2 mm. Body robust, flattened cylindrical, normal, smooth. Whitish like the oak-feeding Tortricids and Pyralids, more yellowish white on the ventral half, dorsum somewhat streaked on the annulets. A sordid blackish-green dorsal vascular stripe; an olivaceous luteous, rather broad, stigmatal stripe, red-brown at the spiracles. Tubercles sordid, blackish, moderate. Feet pale, shields colorous, uncornified; tubercle iv substigmatal, posterior, faintly broadly whitish ringed.

The larvæ occurred on the oak, hiding between leaves and with the aspect of Pyralids, but true Geometrids in structure. They were found by Mr. E. J. Osler, at Cheyenne Canyon, near Colorado Springs.

SCIAGRAPHIA PERVOLATA Hulst.

Larva.—Head rounded bilobed, the lobes squarish, erect, flattened a little before; gray white, a broad black band over the vertices of the lobes and another across from eyes, but leaving the epistoma pale; black dots between the bands; width 1.8 mm. Body normal, not greatly elongate; tubercles elevated; setæ coarse and black. Bark gray; ground color whitish dorsally, but gray between tubercles i and ii; a reddish subdorsal band broken into spots below tubercles i and ii, the rest whitish. Lateral area gray mottled, the substigmatal fold white anteriorly on the segments; venter marked and dotted with grayish black. Tubercle vi double, or of two separate tubercles; i and ii nearly in line, the rest as usual; the tubercles of vii moderately separated. Plates spotted like the body, uncornified.

Found on wild gooseberry in the Platte Canyon, May 18; imago June 12. I am not sure that the moth is correctly named. I could not find any description to exactly fit the specimens; that of *S. pervolata* seems the nearest. The moths have the wings whitish gray, rather coarsely brown strigose; transverse anterior and posterior lines represented by diffuse clouds, the latter bent outward opposite the cell. A black patch at costa and at middle of wing occur just beyond the transverse posterior line and adjoin a broad, pale, ill-defined sub-

terminal band; a terminal broken black line. Hind wings finely stri-gose, the margin wavy with brown discal dot and a shadow of a median line.

DIASTICTIS OCCIDUARIA Packard.

Larva.—Head rounded, erect, squarish, clypeus rather high; whitish, a large black patch covering vertex of each lobe and extending half way down the sides and front, leaving the median suture broadly pale; an angled patch over ocelli and one on lower part of clypeus, pointed above; epistoma pale, mouth black; width 1.6 mm. Body cylindrical, normal, the segments not elongated; feet rather small. Ground sordid white, with many black marks and two brick-red bands. Dorsal and stigmatal bands diffuse, red, the latter broken at the spiracles by the white ground color. Large black spots about tubercles i, ii, and iii, with numerous smaller dots between; iv and v black, v small; a continuous black subventral band, covering tubercle vi, below which the venter is pale gray, dotted by the scattered black tubercles vii and viii, sparsely mottled, becoming pinkish medially. Thoracic feet and spiracles black, abdominal feet gray, like the venter, with black tubercles. No shields; joints 2 and 13 white and black spotted, concolorous. Setæ black, short, stiff.

Found by Mr. Oslar on the ground under willows near Denver. They did not feed, being matured. Moth, May 30.

ALCIS HAYDENATA Packard.

Eggs.—Shortly elliptical, nearly spherical, one diameter a little less but no flattening or truncation; about 14 longitudinal ribs, low, distinct, running to the antemicropylar end where they meet in a slightly confused reticulation. At the other end they stop abruptly at a ridge which represents the edge of the obsolete truncation; end reticulate. Ribs nearly straight, dotted faintly with two rows of pores; cross striæ fine, parallel, not raised, not very distinct. Pale green; diameter 0.9 mm., the difference between the two diameters scarcely measurable.

Laid loose, rolling about in the jar.

Stage I.—Head rounded, mouth rather flatly truncate; dark brown, labrum and antennæ whitish; width 0.35 mm. Body cylindrical, normal; moderately elongate. White; joints 2-4 and 10-13 look a little swollen and are honey yellowish; six red-brown transverse bands on the posterior halves of the segments 4 to 9, joined by a subdorsal line that is wide next to the posterior band, and nearly detached on the anterior rim of the segment; a lateral, more regular line, reaching nearly the whole length; bands broadly blotched on the venter and joined by a fine adventral line. Joints 2-4 and 10-13 marked over the yellowish with clouded dorsal and subdorsal purple-brown lines. Cervical shield and anal plate darkly sordid shaded. Feet dark, nearly black; the thorax and head held so as to look like a single black knot. Feet of

joint 10 paler, especially outwardly. Tubercles and setæ obscure, concolorous and pale.

Stage II.—Head round, bilobed, erect, flattish over the moderate clypeus; dark brown, a disjointed, submaculate, white band over the lobes to the clypeus, a large spot in clypeus, epistoma diffusely whitish, setæ pale; width 0.6 mm. Body cylindrical, moderate, normal. Posterior three-fifths of segments 5 to 9 banded in purplish brown, joined by a subdorsal line, widened where it joins the band in the centers of the segments. A finely linear dorsal line; venter wholly brown, only slightly streaked in whitish. Anterior two-fifths of segments white, annulate and slightly lumpy, cut into dorsal and lateral patches by the distinct subdorsal line. Joints 2 to 4 with the white predominating; dorsal and subdorsal lines uniform, subventral region brown, annulet incisures sordid. Joints 10 to 13 mostly brown, the dorsum luteous diluted; subdorsal, lateral and stigmatal white bands, submaculate, a little lumpy elevated. Feet brown, the abdominal ones white dotted.

Stage III.—Head rounded, flattened before, slightly bilobed, erect; dark brown, a white dotted edged band over the vertex of each lobe to the clypeus which contains some white dots; base of antennæ and motilings on sides below pale; width 0.9 mm. Body moderate, cylindrical, normal. Segments finely irregularly annulate, not greatly elongate. Dorsal band white, widened segmentarily, sordid shaded; subdorsal dark brown, on joints 5 to 9 composed of intersegmental ellipses, narrowly joined and covering all of the lateral space, narrow on the thorax, confused and pale on joints 10–13. Lateral space white on the segments, narrowed to obsolescence in the incisures. Venter broadly dark brown, finely obscurely lined in pale. Feet brown, the abdominal ones whitish lined outwardly. Joint 2 dorsally dark brown as also the tip of the anal flap. White marks slightly mottled and cut by the annulet incisures, also slightly lumpy and folded on the sides. Tubercles and setæ obscure.

Stage IV.—Head rounded, scarcely bilobed, erect; brown-black, white dotted; a broad, short, pulverulently edged, white band on vertex of each lobe, cut off before into a dot; bases of antennæ and epistoma white; width, 1.3 mm. Body as before, black-brown with dorsal and stigmatal, continuous, segmentarily widened, white bands, nearly pure, cut by the fine annulets, containing black dots at tubercles i and iii, respectively. Dorsal band broad on joints 2 to 4, double on joint 2 with triplicate brown center, broadly blurred on joints 3 and 4, brown dotted; powdered and confused with dots on joints 10–12; joint 13 white dotted. Lateral band uniform on joints 2 to 13, the feet of 10 and 13 narrowly white lined without, otherwise dark. Venter finely, faintly lined. Faint orange blotches behind the spiracles.

Stage V.—Head squarish, rounded, thick, flattish before, vertex slightly notched; black, finely white dotted; a broad, rectangular band

on the vertex of each lobe, white, containing two black dots; epistoma white. Dots small, mostly uniform, a little strigose and waved, especially in the clypeus; width 1.7 mm. Body normal, rather robust; brown-black; a broad distinct, sharply edged, white band, narrowed at the segmental incisures, a similar stigmatal one faintly orange blotched below and between the spiracles. Subdorsal space velvety, finely white dotted like the head; venter finely lined in whitish, pulverulently; medio-ventral band rather broad, cloudy triplicate. On thorax the dorsal band replaced by a pair of subdorsal bands, creamy orange tinted, irregular, subconfluent. On 10-13 dorsal band widened, more irregular and containing black dots; tubercle ii of 12 enlarged, white; anal flap black-brown, white dotted; a white bar from the stigmatal line on the upper halves of the feet of joints 10 and 13. Feet and spiracles black; tubercles small; setæ fine, short, dark. Segments finely and rather numerous annulate, finely so anteriorly and posteriorly.

Eggs from a female taken at Pine Grove, July 19. The larva reached the stage last described September 29 and began to hibernate, but had not enough vitality to survive the winter. It was apparently not mature. It fed on wild cherry and *Polygonum*.

ENEMERA JUTURNARIA Guenée.

Egg.—Elliptical, one diameter much less than the other but not sharply flattened, not depressed at either end; micropylar end roundly truncate, the other abruptly rounded, both about alike but differentiated by the sculpturing; truncation slightly oblique. The two sides are not symmetrical. The egg is laid loose, rolling about, and if rolled, always stops with the same side up. This side has a single median impressed groove; the lower side two such grooves. Twelve broad, longitudinal, raised ridges join a similar ridge about the rim of the truncation, broadly waved, rounded, beaded with a double row of minute pores, joined by diffuse transverse ridges to form squares and also by numerous fine, obscure, transverse lines, about eight to the square. Beginning one square from each end the two central ridges are approximated, the space between depressed as a deep, smooth groove. On the other side the two median hollows are depressed, their bordering ridges less sharply approximate, the grooves crossed by striæ. In one egg the double grooves began, one of them at one square, the other at two squares from the truncation, but both ended sharply and evenly at one square from the other end. In another egg this was reversed. In still another there was but a single groove, but it was not central and was less deeply marked than the dorsal one. Micropylar end coarsely reticulate, the upper end lumpy from the confused ridges. Color green, turning dull pink, with the ridges paler. Size, 0.9 by 0.7 by 0.5 mm. Eggs from three females examined, alike

with the variation indicated. The ridges overhang the dorsal groove, projecting as white rims, serrated by the projected pores, which appear as little brown teeth. Ventral grooves more variable, not overhung by the ridges.

The eggs were obtained in July, but did not hatch till the following April. They are evidently scattered over the ground by the moths, where they lie all the autumn and winter. The dry climate doubtless favors their preservation, while their peculiar ribbed structure may serve as a safeguard against too much dryness.

I have described the larva previously.¹

EPIPLATYMETRA COLORADARIA Grote and Robinson.

Eggs.—Laid adherent; elliptical, one diameter considerably less, rounded, rather squarely; both ends abruptly rounded, about alike, not really truncate; center a little constricted and one end a little depressed. About 14 low raised ridges, longitudinal, parallel, stopping at the rim at the micropylar end, reaching the other end confused into reticulations. They carry a double row of pores but obscure, rounded; cross striæ fine, obscure, parallel, not raised. Color pale whitish green. Size 1.1 by 0.8 by 0.6 mm. The rim about the micropylar flattening is more distinct than the ribs; the end is nearly smooth, slightly radially reticulate near the rim.

Stage I.—Head rounded, very slightly bilobed, oblique; very pale brown, a little vertically streaked. Body moderate, normal, whitish, a broad, straight, distinct, pale purple-brown band subdorsally on joints 2 to 13, not quite reaching the end, the pair separate, only touching at the middle of joint 13, where they terminate. A similar broad, pale-brown ventral band. Feet pale, ocelli black, sutures of the moderate clypeus brown.

The eggs were obtained from a female moth at Pine Grove, Colorado, in the foothills at an altitude of 8,000 feet, but no suitable plant could be found for the young larvæ when they hatched.

Family NOTODONTIDÆ.

ODONTOSIA ELEGANS Strecker.

Egg.—Hemispherical, the base flat; opaquely white, not shining; finely and densely covered with small, white granulations, arranged obscurely in vertical lines, a little denser about the vertex, which is narrowly clear with a small central white space. Diameter 1.4 mm.

Stage I.—Head bilobed, free, shining black, the sutures broadly and lower parts of lobes diluted brown; width 0.65 mm. Body cylindrical, normal, anal feet elevated, segments subannulate. White, shining, the quadrate cervical shield, anal plate, leg plates, thoracic

¹Entom. News, V, 1895, p. 63.

feet, and tubercles shining black. A faint vinous shading dorsally on joints 4, 5, 6, and 12, and distinct subventral sordid vinous blotches the whole length. Tubercles normal, ib and iii, especially iii, larger, ia and ib separate, iv behind the spiracle; no subprimaries. Tubercles distinct, polished, black, the setae pale and obscure. Joint 12 slightly enlarged, tubercles i and ii of joint 13 anteriorly in a square; joint 11 rather weak. The larva ate patches halfway through the leaf on the upper surface and rested beside them.

Stage II.—Head erect, high, narrowing above, a low vertical notch, flattish before; pale luteous, the vertices of lobes narrowly tipped in smoky brown, ocelli dark; width 1.2 mm. Body cylindrical, joint 12 slightly enlarged, anal feet weak, approximate, but used. Whitish green, smooth, a white subdorsal line; subventer and feet broadly dark vinous, the anal ones only narrowly lined with this color; thoracic feet black. Tubercles large, a little elevated, but whitish, almost concolorous with the body, inconspicuous. Segments irregularly annulate; no shields.

Stage III.—Head pale greenish luteous, punctate dotted in darker, the sutures of mouth brown, sutures of clypeus and a central line also dark; ocelli blackish; width 1.6 mm. Body cylindrical, normal, joint 12 with a small, sharp, dorsal hump. Green, yellowish shaded on the thorax and along stigmatal line, subventer blotched with vinous, running down on the outer sides of the feet. Anal feet small, vinous lined, used. Spiracles small, black ringed. Segments subannulate, slightly shining, joint 6 with a very slight annular swelling.

Stage IV.—Head high, flattened before and at the sides, vertex slightly notched; pale green, blotched with dull red on the sides below and about the mouth, shading upward; width 2.5 mm. Body cylindrical, joint 6 with a central, slight, collared elevation, 12 with a broad, low hump. Green, the space between the spiracles and the feet broadly shaded in purple brown, slightly shading upward toward the dorsum, more distinctly on the hump and quite darkly on the annular elevation of joint 6. Thoracic feet and abdominal ones outwardly dark purple brown; spiracles black ringed. Tubercles slightly elevated, green; anal feet small, used. Venter broadly pale green. The transverse purple lines of joints 6 and 12 become more distinct with growth. Later the dull vinous color shades nearly up to the dorsal line, the purple dorsal ridges of joints 6 and 12 are slightly relieved by whitish.

Stage V.—Head higher and wider than joint 2, rounded, flattened on the front and sides, narrowed a little above and slightly bilobed; shining, smooth, yellowish green from the clypeus to vertex centrally, the clypeus and sides shade in dark brownish red; mouth dark red; surface shagreened slightly, making the red shade mottled-reticulate in greenish; width, 3.5 mm. Body cylindrical, joints 6 and 12 with

low, collared, dorsal humps; anal plate rounded, smooth, small; no shields. Feet moderate, equal, the anal pair a little smaller, but used in walking. Dorsum shaded in vinous brown mixed with grayish, only a trace of green in the incisures dorsally; venter narrowly green. Thoracic feet red-brown, the foot of joint 7 and the others in a less degree with a purple brown streak outwardly. Humps narrowly pale gray, spotted and streaked in purplish black. Tubercles whitish with black hair dots, a little elevated, distinct, normal. Spiracles large, white, black rimmed. The dark mark on the hump of joint 6 is an irregular black band from behind the spiracle over the dorsum and an elongate spot between tubercles i and iii. Joints 2 to 5 are more reddish than 6 to 13, having no gray; the hump of joint 12 is reddish and the gray consists of traces of the collar markings of joints 7 to 11, most distinct at the spiracles. Later joints 2 to 6 are a little smaller in diameter than the rest of the body, joint 2 slightly widened and pale on the sides. The body becomes all lilaceous except narrowly ventrally with the same marks, but no distinctly different reddish tints. Anal plate with a narrow red rim.

Larvæ found on aspen at Bailey's in the Platte Canyon, mixed with *Pheosia dimidiata*, which they greatly resembled in the egg stage. A larva entered the earth to pupate July 31, and the moth emerged May 6 the following season.

In the last stage the larva rests on the twigs of its food plant, which it closely mimics in shape and color.

Family COCHLIDIIDÆ.

TORTRICIDIA TESTACEA Packard, variety CRYPTA Dyar.

I had no expectation of finding a slug caterpillar in Colorado, as the climate seems too dry. However, Mr. Caudell netted a female moth in a narrow, wooded gulch leading off from the Platte Canyon, not far below Bear Gulch. The moth differs only slightly from the Eastern *Tortricidia testacea*, being paler and less strongly dark shaded, but the larva shows some rather unexpected differences, showing it to be a distinct local variety of that species. The pattern of markings is more generalized in the Rocky Mountain race.

Eggs.—Elliptical, flat, but rather thick and arched, translucent, slightly yellowish, the reticulations obscure; size, 0.8 by 0.5 mm., all as usual in the family.

Stage I.—As in the Eastern species, the subdorsal spines Y-shaped, the anterior prong shortened on the hinder segments, especially on joint 11; not strongly alternating, yet perceptibly so; greenish translucent, the ridges whitish; head green, eye black, mouth brown; skin smooth. All normal, no markings.

Stage II.—Elliptical, joint 13 quadrate, normal, narrowed behind. Depressed spaces large and deep, all present; ridges and latticed elevations between the depressed spaces densely papillose granular, especially around the margin; setae distinct, short, dark, pointed, normal. All faintly whitish; latticed ridges of dorsal space 1 granule wide.

Stage III.—Elliptical, normal. Green, a yellow subdorsal line centrally, reaching farther posteriorly than anteriorly; a round, red spot crossing the subdorsal lines, but yellow edged and paler centered, situated on joints 7 and 8.

Stage IV.—The purplish-red spot is rounded, a little larger than before; yellow subdorsal line not quite reaching the extremities. The larva now eats the whole leaf.

Stage V.—The patch is irregularly triangular, occupying about a third of the dorsum; it covers depressed spaces (1) of five joints and reaches the middle of the side; a red dash on joint 3. The yellow lines reach to the anal end, but not to the head.

Stage VI.—The patch reaches the anterior and posterior extremities narrowly, on the sides to the depressed space (4) of joints 7 and 8, with a little point toward (4) of joints 6 and 9. It is as in the normal *T. testacea*, except that the patch did not reach below the middle of the side, being exactly as in some fully marked examples of *T. caxsonia*. The larva had but six stages.

Eggs June 1, mature larva July 14.

Family PYRALIDÆ.

MELITARA JUNCTOLINEELLA Hulst.

Larva.—Head rounded, slightly bilobed, held flatly; clypeus nearly reaching vertex, the sutures depressed; bright red-brown, epistoma paler, ocelli black; width 2.1 mm. Body slightly flattened, the segments strongly 2-annulate; cervical shield large but rather narrow, transverse, shining black; anal plate very large, black. Tubercles small, black, i and ii in line, iv + v, normal. Feet with the crochets in an ellipse. Dark purplish, nearly black; skin coarsely wrinkly shagreened; spiracles rounded, black. Thoracic feet brown; setae fine, brown, rather long. On the thorax ia + ib, iia + iib; on joint 13 anteriorly a medio-dorsal shield and on joint 2 a small crescent before the spiracle, not contrasted.

Larvæ feeding gregariously within the leaves of the prickly pear cactus were found on the prairie near Denver, May 11. They had obviously passed the winter as half-grown larvæ in this situation and were feeding rapidly. However, it proved impossible to breed them, and the above supposition as to their identity was gained from the capture of a female moth on the prairie near Golden, June 5.

ACROBASIS BETULELLA Hulst.

Larva.—Head round, black, coarsely shagreened, epistoma sordid white. Body purplish black, the segments coarsely 3-annulate, not shining. Tubercles small, black, corrugated radially, iv and v closely approximate, in line. Anal plate black; feet normal, setæ rather long, fine.

Spinning a web among the leaves of birch and living in a cone made of frass united with silk. Platte Canyon; imago July 1.

PIONEA BELIALIS Druce.

Larva.—Head small, flat, half retracted in joint 2. black, the sutures pale. Cervical shield bisected into two quadrangular halves, distinctly separate. Body nearly cylindrical, uniform, robust, incisures only slightly marked; anal plate brownish, feet normal. Pale yellow with large, conspicuous, round, black tubercles; ia+ib, iia+iib, iv+v, iiia present, large, situated above and before the spiracle, vii a single brown-black tubercle, viii distinct on the legless segments. Crochets of abdominal feet in a broad ellipse, narrowly broken outwardly. Thoracic feet black, the abdominal ones like the body. Spiracles small, black-rimmed.

The larvæ are leaf miners in an herbaceous, aromatic plant, *Coleosanthus grandiflora*, growing in bunches in moist spots in the foothills. I found them in a gulch near the mouth of the Platte Canyon. The mine forms a large brown blotch extending through to both epidermes at the terminal part of a leaf, occupying three-fourths or more of the surface. At maturity, the larva emerges and spins up a three-cornered box in one of the soft, young leaves at the end of the shoot where it pupates. This leaf becomes wrinkled with growth.

Larvæ found matured July 11, at which time there were only a few left, most having pupated. The moths began to emerge at once.

A Tachinid parasite, *Isoglossa hustata* Coquillett, was raised from the larvæ.

A specimen of the moth was sent to Prof. C. H. Fernald, who says that it should be referred to the genus *Cybalomia*. He adds that it reminds him in appearance of *Titanio helianthiales* Murtfeldt, which is also a leaf miner in the larval state.

Family PTEROPHORIDÆ.

OXYPTILUS DELAWARICUS Zeller.

Larva.—Head rounded, whitish. Body light green with a rather broad white subdorsal stripe, containing a round creamy patch on joints 6 and 7; feet normal, slender. Tubercles i and ii united, single haired, the hair of i leaning forward, ii backward; tubercle iii single haired, leaning forward, iv and v united, not strongly oblique; vi

single haired, directed backward; vii with three hairs on the leg base, one stronger than the others; no secondary hairs, the skin finely granular. On the thorax tubercles ia and ib united, iia+iih, iii+iv+v, vi double. No shield, but six setæ in two rows, three on the prespiracular wart and two on the subventral.

The pupa is winged as in *O. periscelidactylus* Fitch.

Larvæ on the wild grape in the Platte Canyon, June 1, moth out June 11. The larvæ were mature when found and ready to pupate, but there was no sign on the plants of spun up leaves, such as the allied species makes.

The specimens were at first determined as *O. periscelidactylus*, as they agree with a moth so labeled by Professor Fernald, bred at the Department of Agriculture on grape (No. 4440). The wide dissimilarity of the larvæ (*O. periscelidactylus* has warts and secondary hairs) led me to reexamine the moths. *O. delanvaricus* is extremely similar to *O. periscelidactylus*, much more so than the descriptions by Walsingham and Fernald would imply. It is smaller, the palpi are shorter, the antennæ completely white ringed, and the space between the white lines on the feathers of the fore wing is dark brown, contrasting with the rest of the wing. Otherwise I see no differential characters.

The following are the notes made at the Department of Agriculture on the number 4440, above referred to:

May 29, 1889. Tortricid? on grape from J. B. Schæffer, Deward, Pennsylvania. Larvæ uniformly greenish yellow with darker median line and somewhat paler head. The hairs arising from the warts are long, rather coarse, and colorless. * * * They remind one of *Nola*. Moths issued June 9-11.

PTEROPHORUS SULPHUREODACTYLUS Packard.

Larva.—Thick, flattened, tapering at the ends; feet normal, slender. Head rounded, bilobed, the apex under joint 2, mouth projecting; width about 1.2 mm.; black, the sutures broadly brown. Body without secondary hairs, the warts low and diffuse; i with three or four, ii with one hair, these warts somewhat approximate; iii with several hairs; a group of six hairs on the subventral fold without wart and a hair posteriorly in line, absent on some segments; several hairs for tubercle vi. Olivaceous green, a broken, broad, sordid white subdorsal line along warts i and ii with four black dots on each segment between in a square, becoming black blotches on the posterior segments. Wart iii pale; spiracles black; skin finely dark granular; cervical shield blackish, hairy; thoracic feet black, the abdominal ones pale. Hair white, minutely glandular tipped; segments obscurely 2-annulate, a black impressed lateral dot in the middle of the segment. The larvæ were found webbing up the young heads of a wild sunflower, *Helianthus annuus*, and feeding within the spun mass. They occurred on the foothills near Boulder Creek Canyon. Spun among the leaves; emerged June 10.

PLATYPTILIA COSMODACTYLA Huebner.

Larva.—Head round, vertically bilobed posteriorly, pale testaceous. Body cylindrical, normal, green, a dull crimson dorsal line with a small oblique subdorsal dash on joint 6 and a dash on joints 5 to 12; a white subdorsal line from joint 2 posteriorly to 13 anteriorly and a broken subdorsal one the larger anterior part on each segment oblique. Tubercles small, hairs single, i and ii separate, iv and v approximate, v anterior and dorsal to iv. On thorax ia+ib, iia+iib, iv+v, numerous fine, short, secondary hairs, shorter and easily differentiated from the primary ones, bulbous tipped. Hairs all white, not long, inconspicuous.

The larva was found resting on the red fruit bract of *Lonicera involucrata*, and was not observed to feed, being matured and pupating immediately. Apparently the larvæ do not eat the leaves, but more probably the flowers. Found at Pine Grove, Platte Canyon, altitude about 7,000 feet.

ALUCITA CINERASCENS Walsingham.

Larva.—Head long, the mouth pointed, apex under joint 2; whitish. Body flattened, narrow, not tapering. Tubercles i and ii approximate with one long and several short hairs, iii singled haired, iiib several haired, iv+v large, many haired, the others retracted subventrally. Translucent green, with obscure, straight, subdorsal and broken lateral lines, the latter above tubercle iii. Warts black, i+ii largely so, and forming a double row of distinct spots separated by a straight line of the ground color. Anterior edge of joint 2, posterior rim of reduced cervical shield and warts of anal flap also black marked. Hairs white, spinulose; none secondary. Pupa free, not in a cocoon.

Larvæ in the heads of *Helianthus pumilus*, near Boulder Creek Canyon, May 23; moths issued June 12. Eggs were obtained from these which passed the winter without hatching, showing the species to be single brooded with hibernation in the egg state.

Egg.—Oviform, elliptical, one end more pointed than the other, both slightly truncate at the extreme tips, strongly and sharply flattened on two sides, like cakes cut out of dough; pale yellow, opaque, not shining, the surface slightly shagreened, not sculptured. Size, 0.55 by 0.4 by 0.15 mm.

Family TORTRICIDÆ.

TERAS FOLIANA Walsingham.

Larva.—Head rounded, the apex under joint 2, paraclypeal pieces reaching vertex; red brown, shaded sordid at the mouth, ocelli black; width 1.2 mm. Body translucent, soft green, not shining; cervical

shield large, pale luteous, black rimmed posteriorly. Tubercles large, colorless, a little elevated, normal, iv+v. Male glands large, dark purple. Feet and setæ pale, no marks.

Abundant on the *Cerocarpus parvifolius*, folding the leaves and living within the houses so formed; pupa in a folded leaf. Some of the bushes suffered severely from these larvæ. The moths were common flying over the dry foothills in July among the *Cerocarpus* bushes at Platte Canyon and Manitou; doubtless also throughout the range.

CACOEZIA ARGYROSPILA Walker.

Larva.—Head pale luteous brown, a black line on sides and ocelli black, jaws brown. Body green, cervical shield all green, translucent, tubercles pale, a little elevated, normal; no marks.

Another larva had the head pale brown with a darker line along the side on ocelli and jaws. Cervical shield all translucent green with a trace of brown tint, unbordered. Body all green; first pair of thoracic feet black, the rest green. Dorsal vessel dark.

Another larva had the head black, diluted with whitish irregularly on the face; thoracic feet black ringed, those of joint 4 less strongly so. Cervical shield black edged, luteous centrally, shading to whitish translucent in front. Body all green.

Another larva had the head greenish testaceous, black below at mouth but epistoma pale; width 1.5 mm. Cervical shield translucent greenish testaceous, shading to brown-black at the edges. Body translucent sordid green, slightly olivaceous dorsally, tubercles broadly paler, elevated, rather large; segments coarsely 2-annulate dorsally; male glands faintly yellow. Setæ long, pale, normal; ia+ib, iia+iib, iv+v. No anal plate. First two pairs of thoracic feet blackish marked, the last pair brownish.

I give these several descriptions to illustrate the variability of this larva. It is especially unfortunate, as the larvæ of several other Tortricids are closely similar to this and hard enough to distinguish anyway. The species occurred on oak, willow, ash, and box elder, generally distributed but not locally very abundant.

CACOEZIA VIVIDANA Dyar.

Larva.—Head slightly bilobed, flat, jet-black or partly diluted on the face; cervical shield luteous except for dots at the borders. Body slender, cylindrical, the feet short, segments irregularly 3-annulate. Sordid translucent green, a clearer dorsal and subdorsal line; tubercles round, white, distinct, with coarse white setæ; iv+v. Spiracles black ringed; thoracic feet black with paler joints, abdominal ones pale. Dorsum faintly olivaceous shaded. Male glands in joint 9 showing as an ochraceous shade.

Webbing up the leaves of *Rubus deliciosus* in the Platte Canyon,

May 25. Others from wild cherry mixed with *Cenopsis directana*, from which I do not know how to distinguish them. This is not more than a variety of *Cacoecia argyrospila*; it has the same markings, but bright red brown on a pale yellow ground. All the specimens are from Colorado, while *C. argyrospila* is widely distributed. I have thought best to give it a distinctive name. It has been bred at the Department of Agriculture under the No. 4464.

CACOEZIA SEMIFERANA Walker.

Larva.—Head black, diluted whitish on the face; cervical shield greenish, black on the edges. Body translucent green, blackish from the food. Male glands yellowish, subventral fold somewhat opaque. Feet pale, those of joint 2 black.

Webbing the leaves of oak and apparently confined to this tree. A number of very young ones were collected in the Platte Canyon May 18, mixed with other Micro larvæ on the young oak leaves. Imago, June 11.

CACOEZIA NUGUNDANA Dyar.

Larva.—Head rounded, obliquely extended, pale green, ocelli black, jaws brown. Body tortriciform, slender, normal, rapidly moving. All translucent pale green, tubercles inconspicuous, concolorous, setæ pale and rather long; dorsal vessel dark. Male glands light yellow, distinct. Feet green; no marks.

Spinning up the leaves of the box elder, defoliating the trees in Denver and Golden, not seen on any of the trees in the Platte Canyon. The moth is very like *C. semifera*, but is very markedly paler; I think it a distinct species. The larva is always entirely green in all stages while the other larva has a black head, only becoming whitish on the face in the last stage. The food plants seem constant for both.

Professor Fernald tells me that Professor Riley had named this moth after its food plant as I have done, but I am not aware of any published description nor was he.

CACOEZIA CERASIVORANA Fitch.

These well-known larvæ were found in the Platte Canyon, webbing up a mass of leaves of the wild cherry into a head, within which a large number of them were found. Head, shields, and tubercles are black, the body shaded blackish all over. Male glands yellowish. Imago, June 24.

CACOEZIA ROSACEANA Harris.

Larva.—Head brownish luteous, epistoma white, apex under joint 2. Body all green, slightly shining, no marks; cervical shield large, green, narrowly black rimmed at the sides and behind continuously. Tubercles small, slightly elevated. Thoracic feet pale, the anterior ones dark brown; crochets of abdominal feet in an ellipse.

Other larvæ had the head black or partly brown over the vertex; shield diluted green in front, brown centrally. Body all green without dorsal shade, the feet of joint 2 black. These were bred from a large patch of eggs laid in a flat mass overlapping like shingles. The eggs were on a woodbine leaf, but the larvæ did not like this plant. I bred them on wild cherry. Other larvæ taken on plum, wild cherry, and oak. In stage I the head was shining black, mouth paler; bilobed, held obliquely. Body slender, submoniliform; all pale yellow without shields or plates. Tubercles obsolete, setæ obscure. In stage II the head was pale luteous, the body greenish, transparent, no marks. After that the head and cervical shield were black till the last stage, when the black was more or less replaced by luteous brown. Moths issued August 9.

LOPHODERUS COLORADANA Fernald.

Larva.—Head whitish, bilobed, partly under joint 2. Body slender, all pale green, translucent; segments 3-annulate; tubercles whitish, a little elevated, under lens concolorous, colorless, elevated, and moderately large; iv+v. Shield all concolorous, no marks. Feet normal, crochets in a complete ellipse of several rows.

Spinning a somewhat tube-like web in the seed heads of *Pulsatilla hirsutinum* high on the foothills back of Golden.

CENOPIS DIRECTANA Walker.

Larva.—Head and shield black; width 1.5 mm. Body green, broadly olivaceous shaded dorsally, leaving the tubercles pale, joint 13 green. Thoracic feet black, abdominal ones short, normal. Other larvæ had the head mahogany red, the sutures black; cervical shield partly brown-red in front.

The larvæ occurred on wild cherry in the Platte Canyon in May. The moth is very variable, but a distinct species, I think. Professor Fernald makes it a synonym of *C. reticulatana*,¹ but it may be separated from Northern specimens that I have under that name. Lord Walsingham's figure² can be closely matched by some of my specimens. Others are much suffused with brown.

PLATYNOTA LABIOSANA Zeller.

Larva.—Head flat, the apex under joint 2; shining black, the epistoma and bases of antennæ white; width about 1.2 mm. Body slender, flexible, tapering a little at the ends, scarcely flattened; segments strongly 3-annulate, creased in the incisures. Cervical shield large, black, narrowly bisected by pale; prespiracular and subventral tubercles large, black; thoracic feet shining black, abdominal ones short,

¹Trans. Am. Ent. Soc., X, 1882, p. 20.

²Ill. Lep. Het. Brit. Mus., IV, 1879, pl. LXIV, fig. 4.

normal, green, slightly dark shaded; anal pair dull black. Body slightly translucent sordid olivaceous green, dorsal vessel narrowly dark; the subventral fold looks lighter when well folded; no marks. Tubercles rounded, rather small, slightly elevated, with black hair-tubercles, but the plate concolorous with the skin; iv+v, ia+ib, iia+iib, one above the other. Spiracles black with pale centers. Setæ rather long, dusky.

Webbing up the leaves and stem of *Argemone mexicana*, the pupa in a folded leaf with the end bitten off. Often injurious to the plant, as they eat the growing stem, distorting the plant. Also found on a species of *Gilia*, but perhaps as an accident. Found at Golden and Boulder, near or on the prairie.

The United States National Museum has fragments of two specimens, one labeled in Zeller's handwriting, the other taken by Belfrage in Texas, July 2. Mr. Busck thinks that they may have been part of Zeller's types; they certainly agree with his description. My specimens run larger, though some are of the same size, and the banding on the fore wings is heavier, not being so much confined to the costal edge as in Zeller's specimens. But the sexes are marked alike, which confirms me in the determination, as it is an unusual character in this genus.

Family YPONOMEUTIDÆ.

ORCHEMIA DIANA Huebner.¹

Larva.—Head rounded, bilobed, sutures depressed, pale reddish, whitish on the paraclypeal pieces and mouth, a black line on the posterior side of lobes. Body slender, tapering a little at the ends; translucent greenish yellow, scarcely distinctly colored; a dull white dorsal band of pigment, somewhat cut by the annulets, touching tubercle i, well defined. Tubercles large, black, round, a little elevated; iv+v, normal. A diffuse yellowish white stigmatal band. Setæ moderate, pale. The food shows dark green or sordid, being especially visible subdorsally.

Cocoon large, a broad sheet of white silk, under which the true cocoon is formed, tube like, enlarged in the middle.

The larvæ were very common on the birch in the Platte Canyon, more especially higher up, at an altitude of 7,000 feet; also on the foothills back of Golden at a similar altitude. The birches were often completely defoliated by the larvæ, except for the leaves which served to support the cocoons, though these were often distributed over

¹Professor Fernald identifies this species with the European *O. diana*. I have seen but two specimens of this rare species, and both differ from the American form, of which I possess now a large series. Our moths are very dark, with no trace of the greenish overlying scales of the European ones. They may, perhaps, be separated under the varietal name *betuliperda*.

neighboring low plants. At the Half Way House on the Pikes Peak Railroad, at a similar altitude to the places where this species occurred so abundantly farther up the range, no specimens were seen and the birches were uninjured. The species, therefore, seems to be local in its appearance. Prof. C. P. Gillette spoke to me of this species as one that he had long observed to be destructive to the birch.

The larva lives under a delicate web which it spins over the surface of a leaf, held above the surface by the curl of the leaf. It eats the parenchyma on the upper side, skeletonizing the leaves, which become brown and dry.

CEROSTOMA RUBRELLA Dyar.

Larva.—Flattened, the dorsal section rounded triangular, strongly tapering at both ends. Head small, elongate, held nearly flat, with broad high clypeus, vertex under joint 2; pinkish, mottled over the lobes with large, pale brown spots; clypeus and epistoma, with antennæ and anterior thoracic feet whitish, somewhat mottled; ocelli and tips of antennæ dark; width 1 mm. Body thickest at joints 5 and 6; shields nearly concolorous, not contrasted. Slate gray, dorsal line yellowish brown, pale yellow edged, a little irregular and clouded, faintly cutting the cervical shield, which is pinkish gray, edged with neat black tubercles; stigmatal fold obscure, faintly shaded in yellowish and brown. Feet normal, pale. Tubercles small, black, distinct, whitish ringed; iv and v separate, iv a little dorsad; on joint 3 ia and ib approximate, separate on joint 4; iia + iib, iv + v. Setæ distinct, brownish. A few white lateral dots and some stigmataly; segments obscurely about 6-annulate.

Solitary on the backs of the leaves, perfectly exposed and spinning no web; on *Berberis repens*, Boulder Creek Canyon; also in other canyons, but less commonly. Larvæ active, jumping off the leaves when disturbed.

The moths resemble the European *Cerostoma radiatella* Donovan, which has been recorded also from America. They are similar in shape and size, and are like one form of that variable species in coloration. But they are not variable, my 12 specimens being absolutely uniform, besides which the larva and food plant are different. I have, therefore, thought them deserving of a distinct name.

Palpi clothed with black and a few white scales, longer at the end of the second joint; face black and white scaled; vertex with long red brown vestiture, basal joint of antennæ and neck narrowly white; antennæ white and black banded below. Thorax and fore wings above smooth red brown with bronze reflection, an obscure lighter ray from the base along the submedian vein, distantly edged above with a few black scales which are more distinct on the outer half of the wing. Abdomen and hind wings silky blackish, as are all the wings below, the costa of fore wings only narrowly pale. Legs and abdomen below pale gray, shining. Expanse, 14 mm.

Family GELECHIIDÆ.

GNORIMOCHEMA COQUILLETTELLA Busck.

Larva.—Head rounded, elongate, vertex under joint 2, clypeus triangular, high, not reaching vertex; ocelli black, jaws brown; width 0.8 mm. Body somewhat flattened, incisures distinct, segments faintly 3-annulate; cervical shield reduced, the front part membranous; anal plate large, shining. Skin transversely wrinkled. Tubercles moderate, shining, but weakly cornified, i slightly dorsad to ii, iv + v; ia and ib nearly separate, iia and iib confluent, iv + v. On abdomen the upper seta of iv + v is anterior and smaller. Feet normal, short, the crochets in a small, complete circle, all pale. Setæ moderate, pale. Color sordid yellowish or whitish, head pale testaceous, sutures brown, ocelli black.

The larvæ form false galls on the terminal twigs of *Bigelovia*. The terminal leaves of a young growing tip become united into a fusiform gall-like enlargement, forming a tight box. Every leaf or part of one that touches the inside of the cavity of the box is swollen in that part of its surface; the swollen parts become yellowish and the leaves adhere together, forming the four or five sided box. The tip of the stem bearing the box is recurved. Larva within the hollow, destroying the bud. Frass in the pointed tip. These curious formations, looking like large flower buds, were found commonly in a few places in the Platte Canyon and on the prairie near Denver. When occurring at all, they were generally abundant. They were not found, however, until too late in the season to be successful in rearing the moths. Still, they seem obviously to be the same as the species described by Mr. Busck

As Mr. Busck's paper on the Gelechiidæ, in which his description would naturally appear, is delayed, I have asked him to furnish the description in advance, which he has kindly done. I append it.

GNORIMOCHEMA COQUILLETTELLA Busck, new species.

Antennæ dark brown with narrow silvery white annulations. Labial palpi of typical *Gnorimoschema* form; second joint whitish sprinkled with brown scales and with a black bar on the outside; terminal joint black with a white annulation around the middle. Face whitish; head and thorax whitish, heavily overlaid with dark fuscous. Forewings with basal fifth light yellowish brown, which color is continued outward and downward in a tapering curved streak along dorsal edge to beyond middle of the wing. The ground color in the rest of the wing is pale bluish white with each scale tipped with black. Adjoining the basal fawn-colored area is a semi-circular costal region, heavily overlaid with dark fuscous, and outside this is another similar costal dark area not so well defined. In the first of these dark semicircles, on the middle of the cell, is a dark reddish-brown dot, surrounded by a few fawn-colored scales, and below the second costal semicircle, at the end of the cell, is another similarly edged spot. A few dark fuscous scales are sprinkled irregularly

over the apical part of the wing, and the extreme apex is dark fuscous. Hind wings silvery fuscous, darkest along costa and toward the tip; cilia yellowish. Abdomen dark silvery fuscous; legs whitish, shaded with dark fuscous.

Alar expanse 11.5 to 14 mm.

Habitat.—California

Food plant.—*Applopappus pinifolius*.

Type.—No. 6288, U.S.N.M.

Described from many specimens bred by Mr. D. W. Coquillett and Mr. A. Koebele, from thin-walled oblong galls, formed by the undeveloped bud of *Applopappus pinifolius* near Los Angeles, California.

ANACAMPSIS INNOCUELLA Zeller.

Larva.—Head rounded, flatly outstretched, vertex under joint 2; black or brown with black sutures. Body normal, scarcely flattened, a little smaller at the ends. Cervical shield slightly rugose, brown and black behind and at the sides, shading to whitish before. Skin transparent, appearing white from the fat, food obscurely green; dorsal vessel dark. Tubercles moderate, rounded, black, ia+ib, iia+iiib, iv+v. Thoracic feet black; abdominal ones normal, short; no anal plate.

The larvæ occurred as leaf rollers on the broad-leaved cottonwood (*Populus fremontii wislizeni*) at Denver. The leaf is neatly rolled to several turns, forming a remote spiral, held with cross bands of silk throughout. The end is open, and the larva can be seen in the center. Sometimes several leaves are involved.

NEALYDA BIFIDELLA Dietz.

Larva.—Head small, flat, clypeus rounded triangular, reaching the broad, membranous, vertical triangle, mouth small; pale luteous, sutures of clypeus brown, ocelli small, black. Body moderate, flattened, joint 2 smaller than 3, 4 and 5 equal, then slightly enlarged to the middle of abdomen and a little tapering to end. Segments angularly projecting laterally posteriorly; joint 13 small, divided, the posterior half abruptly smaller. When retracted the segments are flattened moniliform. Thoracic feet small, slender, wide apart; abdominal ones on joints 7 to 10 like slender papillæ, with a spoon-shaped enlargement at tip, in shape much like the thoracic feet, without hooks; no feet on joint 13. Translucent pale yellow, whitish pedally; joint 2 dorsally and ventrally shagreened; no shields. Setæ iv and v distinct, remote, in line, v smaller and just below the spiracle, iv posterior; vi rather distinct, but dorsal setæ obsolete.

Living in blotch mines under the upper epidermis of the leaves of *Allionia nictaginea*, the mine nearly reaching through to the under surface; small for the size of the larva, the frass gathered in a bunch at the end. Found at Salida July 25; moth August 8.

GELECHIA RIBESELLA Chambers.

Larva.—Head rounded, mouth large, projecting, clypeus high; greenish luteous, shining, faintly brownish mottled, ocelli black in an aggregated patch. Body cylindrical, normal, segments 3-annulate; green, a not very bright, white, subdorsal line: shield large, faintly luteous. Tubercles small, without plates, black; ia and ib separate, iia+iib, iv+v. On abdomen iv+v, but not on a common shield; i to iii are distinct, showing as black dots, the rest smaller. Setæ moderate, brownish. Feet all pale.

In spun-up leaves on *Ribes cereum* at Bailey's, in Platte Canyon, July 18; imago July 18.

GELECHIA UNCTELLA Zeller.

Larva.—Head rounded, vertex under joint 2; pale luteous, ocelli black. Cervical shield whitish, immaculate. Body slender, tortriciform, whitish with even purplish-brown bands as wide as the spaces between; subdorsal, lateral, substigmatal with a faint cloud subventrally. Feet all pale. Tubercles minute, setæ fine; spiracles dark. A faint, broken, medio-ventral dark band. Anal plate small, pale. Tubercles iv and v approximate, v dorsad. Tubercles dark, without plates.

Webbing up the leaves, often gregarious, forming a large mass of web and leaves in a ball; on *Lupinus* and *Thermopsis montana* at Boulder Creek Canyon and foothills back of Golden.

GELECHIA PRAVINOMINELLA Chambers.

Larva.—Head pale luteous, shaded over vertices of lobes with reddish; ocelli black. Shields and anal plate pale, translucent, luteous tinted. Body opaquely whitish; subdorsal, lateral and suprastigmatal, blotched, irregularly edged, dull purple bands, leaving the small black tubercles in the pale parts. Tubercles ia and ib separate, iia and iib approximate, iv+v, v very small. A trace of subventral purplish shadings. Setæ moderate, pale. Feet normal, short, green.

The larva folds a young leaf of the aspen with web which reaches down to the petiole and stem, broad, band-like, and cobwebby. It forms a tube within the folded leaf. Found at Pine Grove in the Platte Canyon July 9. Moth emerged July 22.

GELECHIA ANARSIELLA Chambers.

Larva.—Head rounded, apex in joint 2, shining black, labium and epistoma pale. Body rather thick but flattened. Cervical shield large, black, all of joint 2 black, joint 3 vinous black except in front which, with joint 4 in front, is narrowly but conspicuously collared in bright white. Rest of body green, faintly brownish shaded to the spiracles, then clear green; a faint, broad, whitish subdorsal line

along tubercles i and ii. Thoracic feet black; a faint whitish dorsal line; anal flap whitish, dark punctate before. Feet normal, green. Tubercles black, white, ringed; ia and ib separate, iia+iiib, iv+v, v small.

Larvæ on *Ceanothus*, spinning a delicate web over the leaf it is feeding on, hiding in a silken tube in a folded leaf or between leaves. Found at top of Chimney Gulch, Golden, July 9; imago July 20.

GELECHIA VERSUTELLA Zeller.

Larva.—Head pale testaceous, sutures about clypeus, paraclypeal pieces and bases of lobes more or less black shaded. Body moderate, tortriciform, green, with a distinct pale subdorsal line; sides somewhat fluted. Tubercles minute, setæ moderate, white, iv and v united. Feet normal, short; head setæ long, white. When mature the larva becomes shaded with pink and enters a place of concealment to transform.

Found in folded leaves on the cottonwood at Denver, May 31. Moths out June 26.

GELECHIA OCELLELLA Chambers.

Larva.—Head rounded, bilobed, oblique, apex under joint 2 when retraced; luteous brownish mottled, sutures narrowly nearly black, or the head all shining black; epistoma scarcely paler. Cervical shield black with a pale dividing line and luteous patch in each half, or the patch merely a narrow, somewhat impressed dash. Green, dorsum all shaded in purplish; narrow dorsal, broader subdorsal, fainter and slightly broken lateral and stigmatal whitish bands; joints 3 and 4 green dorsally in the incisures. Tubercles pale, concolorous, hair tubercles black; normal, iv+v, ia and ib separate, iia+iiib. Body normal, the incisures depressed. Feet of joints 2 and 3 black, or pale, black tipped. Abdominal feet green.

Found in folded or cut leaves, slightly webbed, on the poison ivy (*Rhus toxicodendron*), in the Platte Canyon July 3; imago July 19.

Family TINEIDÆ.

GRACILARIA PNOSMODIELLA Busck.

Larva.—Head moderately flattened, bilobed, clypeus band-shaped but narrowed to a rounded point at the vertical triangle; pale luteous; mouth and sutures brown. Body nearly cylindrical, segments angularly moniliform, no shields. Tubercles and setæ both pale, somewhat developed, several visible even dorsally. Thoracic feet short, obliquely extended; abdominal on joints 7 to 9 and 13, sessile, with a little bunch of hooks. Dorsum and venter of joint 2 shagreened. All pale yellowish, no marks. Segments subequal, the center of the abdomen a little enlarged.

Mining in the leaves of *Prinosmodium carolinianum* on the prairie at Golden near the foothills. A large blotch mine under the lower epidermis, the upper side a little swollen and yellow. Finally the leaf becomes brown and dead on both sides. Imago July 26. The moths proved to belong to an undescribed species, but Mr. Busck has prepared the following description which is submitted in conjunction with my note on the larva:

GRACILARIA (DIALECTICA) PNOSMODIELLA Busck, new species.

Antennæ as long as fore wings, simple, dark bronzy with indistinct, narrow, white annulations; basal joint without pecten, whitish. Labial palpi silvery white, somewhat loosely scaled beneath toward apex. Maxillary palpi distinct, porrected, silvery white. Fore wings shining coppery golden with silvery white markings edged with black. At basal third is an oblique white costal streak reaching down to the fold, where it bends outward and is prolonged somewhat along the fold; between this and the apex are three equidistant triangular, white, costal spots; the first at middle of wing, the second at the beginning of the costal cilia, and the third in this cilia. Opposite the intervals between these three costal spots are two dorsal, white, triangular spots, and the base of the dorsal edge is white. All these white markings are sharply edged by thin black lines. Dorsal cilia golden, apical cilia white, a short, perpendicular black cross line. Under side of thorax silvery white; legs white with broad black annulations; spurs white; posterior tibiæ pectinated above. Abdomen shining dark purple, with broad white transverse bands on the under side; anal tuft white.

Alar expanse 8 to 9.5 mm.

Habitat.—Colorado (Dyar).

Food plant.—*Prinosmodium carolinianum*.

Type.—No. 6267, U.S.N.M.

This beautiful and singularly marked species may fall in Lord Walsingham's genus *Dialectica*¹ when the group to which it belongs has been critically worked up. *Dialectica* is distinguished from *Gracilaria* by the pectinated posterior tibiæ. It is nearest and very similar in ornamentation to *Coriscium albinatella* Chambers,² but is easily separated by the pure white palpi, by the first costal streak which does not reach down to the white basal part of the dorsal edge, and by several smaller differences in ornamentation.

GRACILARIA THERMOPSELLA Chambers.

Larva.—Head flat, rounded, broadly bilobed at vertex, clypeus triangular, reaching the vertical triangle; smoky luteous, translucent, ocelli black; half retracted in joint 2. Joint 2 flattened dorsally, projecting at the sides, without distinct shield. Segments nearly equal, 4 and 5 a little smaller, tapering a little behind, 13 suddenly smaller, slender, divided. Body behind joint 2 nearly cylindrical, submoniliiform, segments dented subannulate; shining, pale greenish yellow without marks. Setæ nearly obsolete, a few pale ones on the sides. Feet on joints 7 to 9 and 13 with a bundle of hooks directed backward, not in a definite ellipse. Thoracic feet moderate, directed downward.

Leaf miners in *Thermopsis montana* under the upper surface, the

¹Proc. Zool. Soc. Lond., 1897, p. 150.

²Can. Ent., IV, 1872, p. 25.

frass pushed out through a hole below. The larvæ readily emerge from the mine and start a new one in another leaf, entering by a slit which they make on the under side. The mature mine is a large, lobed hollow under the upper epidermis. The young mines are long and tortuous, on the under side, not widening. Found at Baileys in the Platte Canyon July 13. First imago July 25.

LEUCOPTERA ALBELLA Chambers.

Larva.—Head flat, rounded, a band-shaped clypeus, narrowed a little above; whitish, two black ocelli visible on the upper aspect, three on the lower; mouth small pointed, the brown mandibles small, normal. Body slender, flattened, laterally moniliform; joints 2 and 3 larger than 4 and 5, 6 to 10 again a little larger, subequal, 11-12 and 13 tapering, 13 divided, but the segments of equal width. Cervical shield present as a slightly wrinkly area but perfectly concolorous, whitish. Male glands large, filling the whole dorsum of joints 9 and 10, yellowish faintly, segmented. Thoracic feet very short, appressed, projected laterally but not exceeding the edge of the body. Abdominal feet sessile on joints 7 to 10, those on joint 13 a little larger. Venter of joint 2 subcornified, the feet almost rudimentary. White, no marks, no visible setæ.

Leaf miners in the narrow-leaved cottonwood at Morrison and on the foothills back of Golden. A large, black, blotch mine under the upper epidermis, eaten through continuously to the lower epidermis, making a large dead area in the leaf. Several larvæ in each mine, feeding side by side. Frass contained. The larvæ were very abundant where they occurred, nearly destroying all the leaves on large trees, though the individual larva is so minute. When they spun, the remaining leaves of the tree and adjoining foliage were spotted with their white cocoons, covered over by cross bands of silk. First found June 28, by Mr. Caudell.

LITHARIAPTERYX ABRONIAELLA Chambers.

Larva.—Head small, the apex in joint 2, rounded, clypeus triangular, touching the vertical triangle; sordid luteous, mouth brown, sutures of clypeus brownish, ocelli black; labium large. Cervical shield brown, bisected into two triangles, the edge dotted by black tubercles. Body slender, cylindrical, segments submoniliform and almost equal, slightly tapering at the ends. Not shining, rather opaque pale green; tubercles small, black; ia+ib, iia+iib, iv+v on thorax; on abdomen, i dorsad to ii, iv and v remote, iv perceptibly dorsad, vi normal. Segments biannulate, the subventral fold rounded, prominent. No marks.

The pupa is flattened, resembling a seed with a wing-like margin. It is green at first, but soon turns brown. The larvæ form variously

shaped blotch mines, with a hole by which the frass is extruded; they also spin among the terminal leaves or flower bracts with a delicate web in which the frass is contained. The food plant is *Allionia nyc-taginea*. Larvæ from Salida July 25. First imago August 4.

LITHOCOLLETIS CINCINATIELLA Chambers.

Larva.—Strongly flattened, the segments projecting roundedly laterally; joint 2 large, 3 smaller, then gently enlarged to the center and tapering to end. Dorsal and ventral plates the whole length, subcorneous, nearly colorless. No feet; black spots in place of the thoracic feet, and dark scars on joints 7 to 9 and 13. Dorsal marks on joints 2 to 4 just like the ventral foot scars. Head triangular, very pointed, the mouth widened by the transverse, projecting labrum; ocelli black, one remote above the others; palpi projecting nearly at right angles; clypeus band shaped, broadened above, edged by the parallel paraclypeal pieces; pale luteus, sutures and mouth black. Body whitish, purple dotted on the sides of the segments, dark orange on the sides of joint 2 and anterior half of joint 3. A dorsal and ventral diffuse purplish shade, not quite reaching the ends.

The mine is large, 30 mm. or more in length, flat, slightly ribbed; several larvæ in a mine. Found on oak at Manitou. Usually the oaks were not infested with leaf miners, but this place proved an exception. The species were, however, members of the Atlantic Coast fauna. *Lithocolletis basistrigella* Clemens, *L. fitchella* Clemens, and *Tischeria cinctipennella* Clemens were the other species occurring on the oaks at Manitou.

LITHOCOLLETIS SALICIFOLIELLA Clemens.

Larvæ in elliptical blotch mines under the lower epidermis, white, finally eating through to the upper epidermis in dots and patches, usually mostly so about the edges; mine about 17 by 9 mm.; a slight fold down the long diameter. Singly or, rarely, two on a leaf.

Larva.—Head cordate but only very slightly lobed, clypeus high, band shaped, but narrowed to a point where it touches the vertical triangle, whitish, the sutures and a diffuse shade on lateral margin brown; a black speck with a smaller one within on the face of each lobe; several black specks on the ventral aspect of lobe; antennæ small but distinct. Body arched above, gently flattened below, moniliform, joints 3 and 4 larger than 2, 5 small, then gradually larger to 9 and gradually smaller to 13, which is scarcely divided and not sharply smaller. Cervical shield weak, concolorous. Joints 2 to 6 white, 7 to 12 yellow, with large, rounded, brown-black dorsal spots, flattened posteriorly; dark ventral spots on joints 6 to 12 and a faint one on joint 5; joint 13 somewhat translucent, luteous above and below. Thoracic feet large, projected laterally, exceeding the body, well jointed;

abdominal ones sessile, represented on joints 7 to 9 by a bunch of crochets behind and a single row before each planta; on 13 a more distinct foot, with double row of crochets broken on the inside and outside. No feet on joint 10. Setæ long, brownish, from small, distinct tubercles; ia and ib in a group; ib larger; iia and iib somewhat anteriorly placed, iib large; iv and v present. On abdomen i and ii nearly in line, ii larger; iii above and a little behind the small, anteriorly situated spiracle; iv below and well behind; v and vi obsolete. Subprimary tubercles all absent, apparently by reduction. No ventral setæ. Skin finely granular, shagreened, not distinctly so.

Younger larvæ were all colorless, the head the same but with black ocelli at the edge. Anal end well rounded, the segments subequal throughout. Setæ apparently the same.

The cocoon is elliptical, 7.5 by 4 mm., formed in the center of the mine. Mines in the broad-leaved cottonwood in Denver. Imago July 2.

SMITHSONIAN INSTITUTION.
UNITED STATES NATIONAL MUSEUM.

A REVISION OF THE AMERICAN MOTHS
OF THE FAMILY GELECHIIDÆ. WITH
DESCRIPTIONS OF NEW SPECIES.

BY

AUGUST BUSCK,
U. S. Department of Agriculture.

From the Proceedings of the United States National Museum, Vol. XXV, pages 707-468
(with Plates XXVIII-XXXII).

[No. 1304.]



WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1903.

A REVISION OF THE AMERICAN MOTHS OF THE FAMILY
GELECHIIDÆ, WITH DESCRIPTIONS OF NEW SPECIES.

By AUGUST BUSCK,

U. S. Department of Agriculture.

Since Dr. C. V. Riley's List of Tineina¹ nothing has been published on this group in America except isolated descriptions of single species and their life histories.

Dr. Riley followed the classification generally in use at that time, founded on Stainton's and Heinemann's works, although Edward Meyrick² previously had published his masterly rearrangement of the group based on natural evolutionary lines, a work which, as Lord Walsingham has said,³ after the fuller exploitation of the system in the Handbook of British Lepidoptera, "marks an epoch in the study of these insects."

Since then the views of Meyrick have been generally adopted and great strides have been made by European specialists in the study of these insects. A much more satisfactory appreciation of the value and relationship of the genera and families now prevails than was formerly the case.

The following arrangement of the American Gelechiidæ consists in the application to the American fauna of the results of these advanced studies.

In this work I have been greatly assisted by Mr. Edward Meyrick. Numerous concrete questions have been made clear for me by his valuable assistance, which he has most liberally and untiringly extended.

Much kind help also has been received from Lord Walsingham and Mr. John Hartley Durrant, whose large collections and intimate knowledge of the American forms made their aid particularly valuable.

Without the previous work and the liberal help and encouragement from these authorities in England my task would have been much more difficult, if not an impossible one.

As a basis for this paper I have examined all the authentic material of former workers which is still in existence on this side of the Atlantic, together with much new material.

¹In J. B. Smith's List Lep. Bor. Am., 1891.

²Trans. Ent. Soc., London, 1883.

³Proc. Zool. Soc., London, 1897.

From Miss Mary Murtfeldt, the Nestor among students in this group in America, I have received not only material but also much interesting information, which no one else could have supplied, particularly concerning some of Chambers' species.

To Prof. C. H. Fernald and to Dr. William G. Dietz I am under obligation for allowing me to study their collections in their homes, also for various suggestions and for specimens.

Professor Fernald's collection included that of Miss Murtfeldt, with her types and many of the types of Chambers and of Lord Walsingham. Of especial value were those specimens furnished with Lord Walsingham's blue labels, which were passed upon by him in 1882.¹ A notebook in Lord Walsingham's handwriting, with notes and determinations, corresponding to the numbers on these blue labels, was loaned me by Professor Fernald, thus enabling me also to verify identifications of many specimens in the Museum of Comparative Zoology, Cambridge, Massachusetts, especially those which formerly belonged to the Peabody Academy of Science, in Salem, Massachusetts.

Dr. Dietz's collection contained his types and several specimens named by Lord Walsingham.

The collection in the museum in Cambridge contains nearly all of Zeller's types and a great many of Chambers', besides the specimens named by Lord Walsingham. This collection proved the richest of any in authentic specimens, and although careful discrimination was necessary among Chambers' types, many species were identified here which would otherwise have remained unknown to me. I am indebted to Mr. Samuel Henshaw for much courtesy and information given me during my stay in Cambridge, as well as for sending me many specimens needed for reexamination after my return to Washington.

The collection of the Philadelphia Academy of Natural Sciences has unfortunately but a few of Clemens' types left. There are, however, some types and specimens named by Lord Walsingham. To the curator, Dr. H. Skinner, I owe thanks for giving me every facility for examining the collection and manuscripts.

The Belanger collection, formerly in the Laval University, Quebec, containing Chambers' types of Canadian *Tineina*, was obtained by the writer through the courtesy of the present curator, Rev. Dr. C. E. Dionne, and is now in the U. S. National Museum.

What little was left of the late Mr. William Saunders' collection of *Tineina*, consisting of fragments of some of Chambers' types, was secured, together with some new Canadian material for the U. S. National Museum, through the kind agency of Dr. J. Fletcher, Ottawa, Canada.

From Mr. William D. Kearfott I received for study a well-pre-

¹Trans. Am. Ent. Soc., Phila., X, 165-204.

served collection of about 800 unnamed American Gelechiidæ with the most liberal permission to retain desired specimens.

Smaller collections, on similar liberal conditions, have been received from Mr. Nathan Banks and through Dr. Harrison G. Dyar from Dr. W. Barnes and Prof. C. P. Gillette.

Rev. Dr. Fyles has kindly sent me certain specimens and information.

Finally and principally, there was the collection in the U. S. National Museum, which contains many types of Riley, Murtfeldt, Walsingham, Chambers, and Zeller, besides a great many specimens determined by Lord Walsingham and Mr. William Beutenmüller, together with a considerable number of bred or collected miscellaneous specimens, including the collections of Dr. H. G. Dyar, in Florida, Colorado, and elsewhere; of Mr. E. A. Schwarz, in Texas, Arizona, and Colorado; of Prof. T. D. A. Cockerell, in New Mexico; of Messrs. Coquillett and Koebele, in California; and fine series of many species, with notes, bred during many years in the insectary of the United States Department of Agriculture, largely by Mr. Th. Pergande. The Museum also contains Dr. Ottmar Hofmann's large collection of excellently mounted specimens of European species, authentically determined, which naturally has proved of very valuable assistance.

Mr. Coquillett has kindly given me his private notes on some of his bred specimens. These are credited under the species.

To Dr. Harrison G. Dyar I owe much gratitude for the continued interest and encouragement given me during my studies, as well as for actual help, and last, but not least, for aid in reading and correcting this manuscript and proofs.

The purpose of the present paper is not to present an exhaustive monographical treatise on American Gelechiidæ. The group is not well enough known as yet for such treatment. It is rather a revision of what has already been done, so that future work may proceed on a sounder foundation.

The genus *Gelechia* has been for former workers much as Chambers expressed it, "a waste box, a convenient receptacle for every species which could not be better disposed of."¹

Such new genera as were erected from this miscellaneous aggregation, especially those separated by Chambers, were most frequently given insufficient characterization. To study these genera critically, to substantiate and define more fully those which were found tenable, and to eliminate those erected on superficial characters, and then to place as far as possible the described species where they belong has been the principal object of the writer.

For this reason I have described only about 50 new species, such as

¹Can. Ent., IX, p. 231.

had been either bred or belonged to some specially interesting group or were so commonly received for determination as to make a name for them desirable.

If my purpose had been to describe new species, four times as many could as easily have been found in the material at my disposal, but it was believed that the ultimate benefit to science would be better served by leaving these many species unnamed until they have been bred or at least had been obtained in larger and more well-preserved series than we have at present.

Of the 43 genera included in the family Gelechiidæ in Riley's list, 21 have been removed to other families and 8 more have been found to be synonyms of other genera; while, on the other hand, one genus has been recovered from another family in Riley's list, 5 old genera of American authors have been resurrected, 9 genera from other faunas have been identified in America, and 6 new genera have been added, of which 3 are described in the present paper, thus making 35 genera now recognized as North American.

In Riley's list the genus *Gelechia* contained the large number of 213 species, not counting most of Walker's species and some others which were omitted. The number has now been reduced to less than 100, and of these 54 remain in the genus only because they are unrecognized, and they are therefore liable to be removed to some other genera when identified. These unrecognized species are the great drawback to work in this group. The types and all authentic material of most of them are lost, and the descriptions furnish no clew to their proper genera, rendering recognition very difficult and uncertain. Still several of them may be rediscovered, especially by diligent search in Chambers' old collecting grounds in Kentucky, from where, practically, no material has been received since his death.¹

The collections of the British Museum remain to be studied; there should be found the types of Walker's unrecognized species, as well as some of Clemens', which he sent to Stainton forty years ago.

The family Gelechiidæ as defined by Meyrick and as used in this paper comprises moths with the following characters: Head smooth or at most slightly ruffled. Antennæ simple or slightly serrate, rarely ciliate, in a single American genus with pecten on the basal joint. Labial palpi long, curved, ascending; terminal joint usually acutely pointed. Maxillary palpi obsolete or very small, appressed. Posterior tibiæ more or less rough haired above.

Forewings normally with 12 veins, sometimes with only 11 or 10 by coincidence of veins; 7 and 8 normally stalked, sometimes coincident;

¹ The writer has, since this was written, been so fortunate to have a short but strenuous collecting period in this locality, securing much valuable material of Tineina, among which, however, were strangely few Gelechiidæ. It is hoped that in the future the active cooperation of local entomologists may be counted on.

7 to costa; vein 1b furcate at base. Hindwings normally with 8 veins, exceptionally with only 7 or 6 by veins 6 and 5 being obsolete; vein 8 more or less distinctly connected with the cell by a cross vein. The form of the hindwing is more or less trapezoidal, termen is usually sinuate or emarginate below apex.

This last character is always diagnostic when present, as it is not found outside of this family. In the few more generalized genera, where the termen is not sinuate, veins 7 and 6 in the hindwings are approximate, connate, or stalked, thereby differing from the nearest allied family *Oecophoridae*.¹

The larvæ of Gelechiidæ exhibit great differences in coloration and habits. Normally they have three pairs of thoracic feet, five pairs of abdominal prolegs, and feed in folded or spun leaves or shoots or in stems or seed heads. Less commonly they are leaf miners.

They spin a cocoon, and the pupa does not protrude when the imago emerges. The pupa has segments 9–11 free.

In separating the genera in the Gelechiidæ the wing venation and the characters of the labial palpi are especially employed; of these the former is by far the most important.

While differently modified palpi and other external characters, as modifications of the antennæ, the presence or absence of raised scales, or hair pencils of different forms, may indicate generic differences, they are far less reliable than the venation, and only to be taken into consideration in connection with it.

These external characters are more apt to be modified by changed life habits or other influences in the adaptation to environments, but the venation will only undergo changes slowly through a long period of evolution, and is consequently more important in the determination of genera. This is strikingly illustrated by finding the identical characteristic tufted palpi in different families; in *Yponomephus* and *Leuce* in the Gelechiidæ, in *Eumeyrickia* in the *Oecophoridae*, and in *Plutella* in the *Plutellidæ*.²

The raised scales on the forewings are found here and there in all the families, while the hair pencil in the male at the base of the hindwings, used as the sole character by Lord Walsingham to distinguish his genus *Eucatoptus* from *Aristotelia* is found in several Gelechiid genera, and is not constant within these.

Even such a specialized modification as the antennal notch found in *Glyphidocera* and *Anorthosia* in the Gelechiidæ recurs again in the

¹ As defined by Meyrick in his Handbook of British Lepidoptera.

² This might at a superficial view appear to prove just the opposite, and the palpi be claimed to be the persistent character while the venation had undergone changes; but it is very evident from the relationship, or rather lack of relationship, that this is not the case and that the tufted palpi are developed independently in the different families.

Blustobasidae and a very similar one in the genus *Bucculatrix* in the Tineidae.

The reason for these strangely recurring specializations is difficult to explain and will not be fully understood before we learn the true biological use of them, but that they do recur is sufficient proof of their secondary value as generic characters.

Thus it will be found that within the same genus the palpi may vary considerably, while the venation will be found to be very constant, at most varying in the coincidence of two veins, already long-stalked in the allied species, or the obliteration of a transverse vein, which in the related forms had a tendency to become obsolete.

Of the 35 genera now recognized in this family from North America 7 are widely distributed, cosmopolitan or nearly so; 7 others are found in Europe; 2 are recorded from Africa, and 19 have not been recognized outside of North America, including the West Indies.

They may be separated by the following synoptic table:

Forewings with veins 7 and 8 out of 6	1
Forewings with vein 6 separate or out of base of 7	11
1. Basal joint of antennæ with pecten	<i>Sitotroga</i> , p. 781
Basal joint without pecten	2
2. Forewings with one or more veins absent	3
Forewings with all veins present	4
3. Forewings with vein 11 absent	<i>Ignippe</i> , p. 780
Forewings with vein 11 present	<i>Illeis</i> , p. 804
4. Hindwings with veins 3 and 4 separate	5
Hindwings with veins 3 and 4 connate or stalked	7
5. Hindwings of male with costal row of bristles	<i>Glauce</i> , p. 783
Hindwings without such row	6
6. Second joint of labial palpi with long spreading hairs	<i>Paltodora</i> , p. 775
Second joint of labial palpi merely rough-haired beneath	<i>Melzneria</i> , p. 773
7. Hindwings with vein 6 absent	<i>Eriippe</i> , p. 805
Hindwings with vein 6 present	8
8. Forewings with veins 3 and 4 stalked	<i>Trypanisina</i> , p. 815
Forewings with veins 3 and 4 not stalked	9
9. Forewings with veins 2, 3, 4, and 5 separate equidistant	<i>Epithectis</i> , p. 816
Forewings with veins 2, 3, and 4 approximate, long; vein 2 distant, short ...	10
10. Second joint of labial palpi with long expansible tuft on inner side.	
	<i>Eucordylea</i> , p. 807
Labial palpi without such tuft	<i>Recurvata</i> , p. 807
11. Forewings with veins 2 and 3 stalked	12
Forewings with veins 2 and 3 separate	16
12. Second joint of labial palpi with long projecting tuft	13
Labial palpi without such tuft	14
13. Tuft expansible	<i>Anorthosia</i> , p. 917
Tuft not expansible	<i>Ypsolophus</i> , p. 920
14. Hindwings narrower than forewings	<i>Strobisia</i> , p. 904
Hindwings broader than forewings	15
15. Male antennæ with deep notch near base	<i>Glyphidocera</i> , p. 916
Male antennæ without such notch	<i>Trichotapha</i> , p. 906
16. Forewings with one or more veins absent	<i>Menesta</i> , p. 902
Forewings with all veins present	17

17. Hindwings (at least in male) bilobed	18
Hindwings not bilobed	19
18. Hindwings with vein 6 present	<i>Neodactylota</i> , p. 835
Hindwings with vein 6 absent	<i>Nealyda</i> , p. 790
19. Hindwings with a vein absent	20
Hindwings with all veins present	21
20. Hindwings with vein 6 absent	<i>Chrysopora</i> , p. 792
Hindwings with vein 5 absent	<i>Deudonta</i> , p. 837
21. Hindwings with veins 6 and 7 parallel	22
Hindwings with veins 6 and 7 approximate, connate, or stalked	27
22. Hindwings with veins 3 and 4 separate	23
Hindwings with veins 3 and 4 connate or stalked	25
23. Second joint of labial palpi with long projecting tuft	<i>Leuce</i> , p. 793
Second joint of labial palpi without such tuft	24
24. Costal margin of forewings impressed before apex	<i>Euchrysa</i> , p. 919
Costal margin of forewings normal	<i>Aristotelia</i> , p. 794
25. Hindwings of male with costal hair pencil	<i>Plithorhina</i> , p. 821
Hindwings of male without hair pencil	26
26. Second joint of labial palpi with large divided brush, terminal joint thickened	<i>Gnorimoschema</i> , p. 823
Second joint without divided brush; terminal joint thin	<i>Paralechia</i> , p. 820
27. Hindwings with veins 3 and 4 separate	28
Hindwings with veins 3 and 4 connate or stalked	29
28. Second joint of labial palpi with long projecting tuft	<i>Autoneta</i> , p. 782
Labial palpi without such tuft	<i>Telphusa</i> , p. 783
29. Terminal joint of labial palpi in male short, concealed	<i>Anarsia</i> , p. 923
Terminal joint long, exposed	30
30. Second joint of labial palpi rough beneath	<i>Gelechia</i> , p. 851
Second joint of labial palpi smooth	31
31. Terminal joint of labial palpi thickened, laterally compressed	<i>Prostomus</i> , p. 837
Terminal joint slender	32
32. Hindwings with termen sinuate	33
Hindwings with termen not sinuate	<i>Anacamptis</i> , p. 844
33. Terminal joint of labial palpi shorter than second	<i>Polyhymna</i> , p. 839
Terminal joint longer than second	<i>Apocremna</i> , p. 840

METZNERIA Zeller.

Plate XXVIII, fig. 1.

Metzneria ZELLER, Isis, 1839, p. 197.

As Lord Walsingham has shown,¹ this name should be used for the genus, which Duponchel² later named *Parasia*, under which name it is treated by Meyrick.³

This genus is defined by Meyrick as follows:

Labial palpi very long, more or less thickened with somewhat loose scales, terminal joint much shorter than second. Forewings elongate, narrow, pointed 7 and 8 out of 6. Hindwings under I, elongate-trapezoidal, apex acute, produced, termen sinuate, cilia 2; 3 and 4 remote, parallel, 5 approximated to 6, 6 and 7 somewhat approximated.

¹ Ent. Mo. Mag., XXXV, 1899, p. 199.

² Cat. Meth. Lep. Eur., 1846, p. 350.

³ Handbook British Lepidoptera, 1895, p. 570.

The genus is very near and correlated with *Paltodora* Meyrick, developed from *Aristotelia* and differing mainly in the labial palpi. This difference has proven even less marked than defined by Mr. Meyrick, by the knowledge of allied forms in the American fauna and the consequent widening of the genus *Paltodora* (p. 775).

Three species have been described as *Parusia* from America, namely:

1. *Apicistrigella* Chambers, afterwards transferred by Chambers to *Gelechia*. This species is an *Approxema* and will be found treated under that genus (p. 840).

2. *Griseella* Chambers, afterwards transferred by Chambers to *Gelechia*. This species probably does not belong to either genus, but is at present unrecognized and will be found treated under the doubtful species of *Gelechia* (p. 890).

3. *Subsimella* Clemens. This species, which was placed with a query in *Parusia* by Clemens, and which subsequently has been retained there, can not, as the description proves, belong in this genus. It will be found treated under *Epithectis* (p. 816).

Thus the following species is the only representative of the genus *Metzneria* at present recognized from America.

METZNERIA LAPPELLA Linnaeus.

Metzneria lappella STAUDINGER and REBEL, Cat. Lep. Eur., II, No. 2491, 1901.—
BUSCK, Dyar's List Amer. Lep., No. 5539, 1903.

This well-known European and Asiatic species, not hitherto recorded from America, has probably within quite recent years extended its range to this country.

Two years ago Mr. Samuel Henshaw submitted to me several specimens, which he had bred in 1899 from the heads of burdock collected in the swamps around Cambridge, Massachusetts. I had no difficulty in referring them to this species, but sent specimens to Mr. Meyrick, in England, for authoritative substantiation, and he kindly informed me that it was *lappella* Zeller.

I have also identified it in Professor Fernald's collection, bred from burdock in Ontario, Canada. In the U. S. National Museum are, besides the specimen received from Mr. Henshaw, others received from Rev. Thomas W. Fyles, Quebec, Canada, and a large series bred by the writer from heads of burdock received from Mr. Arthur Gibson, of the Department of Agriculture, Ottawa, Canada. Several larva are often found in a single head, and from a small handful of heads sent by Mr. Gibson nearly 100 moths issued.

The larva is short and thick, yellowish white, with brown head; thoracic feet small, and abdominal legs nearly obsolete.

The species overwinters as larva and does not pupate before the spring; the imago issues in May and June.

PALTODORA Meyrick

Plate XXVIII, fig. 2.

Cleodora (CURTIS), Meyrick, Handbook Brit. Lep., 1895, p. 571.

This genus is defined by Meyrick in his Handbook British Lepidoptera, 1895, as:

Second joint of labial palpi with long, rough, spreading hairs beneath, terminal as long as second. Forewing 7 and 8 out of 6. Hindwing under I, elongate-trapezoidal, apex pointed, produced, termen emarginate, cilia 3; 3 and 4 remote, parallel, 5 nearer 6, 6 and 7 approximated.

Most of the American species differ from this definition in having terminal joint of labial palpi shorter than second joint, and veins 6 and 7 in hindwing are more properly said to be connate than approximate. In all other respects they agree absolutely, and the chief characteristics of each species are so unmistakably near to the European forms that one genus only can find justification, and the definition of the genus should be widened by the two alterations—terminal joint as long as second *or* shorter, and 6 and 7 in hindwing approximate *or* connate.

I have recognized the following 12 species, which may be separated by the table, but great care should be taken in determining the species, as they are very similar:

With white costal streak at beginning of cilia.....	1
Without such streak	7
1. Part of costal edge, white	2
Costal edge, not white.....	4
2. With white dashes in costal cilia.....	<i>magnella</i> , p. 776
Without such dashes	3
3. Ground color light yellowish brown	<i>pallidistrigella</i> , p. 776
Ground color dark brown	<i>unicostella</i> , p. 778
4. Head and thorax whitish	5
Head and thorax brown	6
5. Antennæ nearly unicolorous	<i>striatella</i> , p. 775
Antennæ sharply annulated	<i>ciliolineella</i> , p. 777
6. With dorsal apical white streak	<i>dictyiella</i> , p. 777
Without such	<i>anteliella</i> , p. 778
7. Entire wing with white-tipped scales.....	8
No white-tipped scales or only at margins	9
8. Anterior wings with longitudinal ochreous streaks	<i>simuliella</i> , p. 779
Without such streaks	<i>pallidella</i> , p. 780
9. Color light yellowish brown	<i>sabulella</i> , p. 778
Color dark ashy brown, alar exp. 16–23 mm	<i>tophella</i> , p. 780
Color pale umber brown, alar exp. 10–11 mm.....	<i>modesta</i> , p. 781

PALTODORA STRIATELLA Hübner.

Paltodora striatella HÜBNER, Staudinger and Rebel, Cat. Lep. Eur., II, No. 293b, 1901.—BUSCK, Dyar's List Amer. Lep., No. 5540, 1903.

Cleodora striatella WALSHINGHAM, Insect Life, I, 1888, p. 82.—RILEY, Smith's List Len. Bor. Am., No. 5516. 1891.

This European species has been recorded by Lord Walsingham from Colusa County, California. In the United States National Museum is a good series of authentic European specimens. I have met with a single specimen in the Henry Edwards collection in the American Museum of Natural History in New York, presumably from the United States but without locality label.

It feeds, according to European writers, in stems of *Tanacetum*, a weed common also in this country.

Veins 6 and 7 in hindwings are closely approximated.

PALTODORA PALLIDISTRIGELLA Chambers.

Cleodora pallidistrigella CHAMBERS, Can. Ent., VI, 1874, p. 244; U. S. Geol. Surv., Bull., IV, 1878, pp. 92, 135.—WALSINGHAM, Insect Life, I, 1888, pp. 81, 82.—RILEY, Smith's List Lep. Bor. Am., 1891, No. 5514.

Paltodora pallidistrigella BUSCK, Dyar's List Amer. Lep., 1903, No. 5541.

The type No. 467, U.S.N.M., received from Chambers and bearing a label in his handwriting, agrees well with the description and undoubtedly represents this species. This is the same specimen which Lord Walsingham had before him in 1888, and it has his blue label, No. 1184.

The white costal edge, together with the nearly perpendicular white costal streak and its light yellow color, separate it from the other species at present known; I have two other specimens beside the type agreeing exactly with this. They are like the type from Texas.

This is the species which differs most from Meyrick's definition of the genus in respect to labial palpi, the terminal joint being only half as long as second joint; veins 6 and 7 are distinctly connate.

PALTODORA MAGNELLA, new species.

Paltodora magnella BUSCK, Dyar's List Amer. Lep., 1903, No. 5542.

Antennæ dark brown, annulated with white. Labial palpi white, a small oblong spot on the upper and outer side of second joint dark brown, tip of terminal joint dark brown.

Face, head, and thorax white, slightly shaded with brown. Anterior wings yellowish gray, two outer thirds of costal edge white; a small black spot on fold and two elongated black white-edged dashes on the middle of the wing in continuation of each other, sometimes forming one uninterrupted black line.

From apical fourth of costa a thin oblique white line outward to termen; above this four white dashes in the costal cilia, and opposite it correspondingly a dorsal white line emitting three white pencils into the dorsal cilia; cilia whitish with three heavy black transverse lines at apex. Hindwing dark gray, cilia yellowish. Legs light brown, tarsi white, annulated with black.

Alar expanse.—15.5 to 16.5 mm.

Habitat.—Colorado.

Type.—No. 6345, U.S.N.M.

Other specimens are in Dr. Dietz's collection, where it was labeled *striatella* Hübner, from which species it differs by the white costal edge and the stronger annulation of the antennæ, besides being a much larger species.

PALTODORA CILIALINEELLA Chambers.

Gelechia cilia lineella CHAMBERS, Can. Ent., VI, 1874, p. 242; Bull. U. S. Geol. Surv., IV, 1878, pp. 91, 142; Can. Ent., X, 1878, p. 52.—RILEY, Smith's List Lep. Bor. Am., 1891, No. 5337.

Paltodora ciliolineella, BUSCK, Dyar's List Amer. Lep., 1903, No. 5543.

Chambers pointed out the great similarity of this species to his species of *Cleodora*, and added:¹

I have not examined the neurulation, but I am inclined to transfer the species to *Cleodora*.

I have compared the type No. 445, U.S.N.M., bearing Chambers's own label, with his type in the Museum of Comparative Zoology in Cambridge. They are identical and agree well with his description, evidently truly representing the species.

They are *Paltodora*, with the brush on second joint of labial palpi somewhat rubbed off.

The species is very near *pallidistrigella*, differing principally in the absence of the costal white edge and in the direction of the costal white line, which in this species is nearly parallel with the edge of costal cilia, while in *pallidistrigella* it is nearly perpendicular on it.

The differences pointed out by Chambers (Ref. 2) are not well borne out by his types.

Veins 6 and 7 of hindwing are connate.

PALTODORA DIETZIELLA, new species.

Paltodora dietziella BUSCK, Dyar's List Amer. Lep., 1903, No. 5544.

Palpi missing. Antennæ silvery white with dark brown annulations. Face white; head and thorax light fawn colored. Forewings fawn colored, at base concolorous with thorax, but becoming deeper toward the tip; on fold at middle of the wing a small black streak; at end of disk a small black dot. At the beginning of costal cilia obliquely outward across the tip of the wing a thin white line, and opposite it from the dorsal edge another thin white line curved upward and outward, nearly but not quite meeting the costal streak at the dorsal edge near the tip; both are continued out into and meet in the dorsal cilia, which is yellowish fuscous and contains two other white pencils below the continuation of the streaks.

In the cilia at apex is one heavy black transverse line, and outside

¹ Bull. U. S. Geol. Surv., IV, p. 91.

this three thin black lines. Edging the costal white streak superiorly is a dark brown patch.

The ornamentation is very near that of *pallidistrigella*, with the same ground color and general pattern, but differs in the lack of the white costal edge and in the direction of the white costal streak, which in this species forms a narrow Greek ν with the dorsal streak, while in *pallidistrigella* it is shorter and much more nearly perpendicular.

Hindwings dark fuscous, cilia a shade lighter; veins 6 and 7 connate. Abdomen yellowish fuscous, with numerous scattered metallic blue and greenish scales. Legs light yellow.

Alar expanse.—16 to 16 mm.

Habitat.—Colorado. July.

Type.—No. 6346, U.S.N.M.

Cotypes in collection of Dr. Dietz, who has liberally submitted this species to me for description and in whose honor I name it.

PALTODORA CANICOSTELLA Walsingham.

Cleodora canicostella WALSHINGHAM, Insect Life, I, 1888, p. 82.—RILEY, Smith's List Lep. Bor. Am., 1891, No. 5518.

Paltodora canicostella BRUCK, Dyar's List Amer. Lep., 1903, No. 5545.

Described from Mount Shasta, California; cotypes are in U. S. National Museum, where is also a specimen from Colorado. Veins 6 and 7 in hindwings are connate.

PALTODORA ANTELIELLA, new species.

Paltodora anteliella BRUCK, Dyar's List Amer. Lep., No. 5546, 1903.

Antennæ light fawn colored; labial palpi fawn colored, above whitish; face, head, and thorax light fawn colored. Anterior wings darker reddish brown; one short longitudinal streak on the fold and one similar in the middle of the wing black; second discal stigma circular black. From costal apical one-fourth very obliquely outward across the wing to termen a thin white line. Cilia fawn colored with a short, heavy black transverse line in apical part. Hindwings dark gray; cilia fawn colored; abdomen and legs light reddish brown; tarsal joints slightly tipped with white.

Alar expanse, 12 to 12.5 mm.

Habitat.—New Jersey.

Type.—No. 6347, U.S.N.M.

Cotypes in collections of Dietz and Kearfott. The small size and rich brown color make this species easily recognizable.

PALTODORA SABULELLA Walsingham.

Cleodora sabulella WALSHINGHAM, Insect Life, I, p. 83, 1888.—RILEY, Smith's List Lep. Bor. Am., No. 5520, 1891.

Paltodora sabulella BRUCK, Dyar's List Amer. Lep., No. 5547, 1903.

Described from Colusa County, California. Cotypes are in U. S.

PALTODORA SIMILIELLA Chambers.

Gelechia similietta CHAMBERS, Can. Ent., IV, 1872, p. 193

Gelechia solaniella CHAMBERS, Can. Ent., VI, 1874, p. 242; Bull. U. S. Geol. Surv., III, 1877, p. 91, IV, 1878, pp. 91, 147.

Gelechia [*Doryphora*] *piscipellis* ZELLER, Verh. k. k., zool.-bot. Gesell. Wien, XXIII, 1873, p. 277.

Gelechia piscipellis RILEY, Smith's List Lep. Bor. Am., No. 5450, 1891.

Gelechia piscipalis CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 145.

Paltodora similietta BUSCK, Dyar's List Amer. Lep., No. 5548, 1903.

Not *Gelechia solaniella* CHAMBERS, Can. Ent., V, 1873, p. 176; Cinn. Quart. Journ. Sci., II, 1875, p. 239; Can. Ent., IX, 1878, p. 51

This species has been quite troublesome to clear, owing to an erroneous determination by Chambers and the subsequent results of this mistake.

Only by the kind help of Miss Mary Murtfeldt's personal recollection, and with all obtainable evidence carefully examined, did I feel justified and confident in my conclusions in regard to the above synonymy.

Later I have had the satisfaction to have them substantiated in part through a letter from Lord Walsingham in the archives of the Division of Entomology, U. S. Department of Agriculture.

Chambers described¹ a species as *Gelechia similietta*. This was the same species that Zeller subsequently described as *piscipellis*, as comparison of the original types now in Cambridge, but presented by Chambers to the Peabody Academy of Science in Salem, shows, and it is a true *Paltodora*.

In 1873 Chambers received from Miss Murtfeldt a superficially similar species, which she had reared from *Solanum*, and believing it (wrongly) to be *similiella* Chambers, he changed that name to *solaniella* and gave *Solanum carolinensis* as its food plant,² and later he described it³ more fully and gave the life history in detail, still supposing it to be his original *similiella*.

Afterwards Miss Murtfeldt, unaware of this, described her species as *cinerella* Murtfeldt, afterwards changing it to *inconspicua*, the former name being preoccupied in Europe.

It was, however, already described by Zeller as *Gelechia* (*Bryotropha*) *glochinella* and belongs in Mr. Meyrick's recent genus *Phthorimaea*. (p. 821.)

To enable me to draw these conclusions I have had the good fortune to have the following authentic specimen for examination: 1. U. S. National Museum, type, No. 459, Chambers type with his label: *Gelechia solaniella* Chambers. This is identical with 2. the other original type sent to Peabody Academy, Salem, now in Museum of Comparative Zoology, bearing Lord Walsingham's blue label, No. 992 and Chambers' label No. 37, each referring to respective lists of the

two authors, which I have had the use of through the kindness of Professor Fernald, and Mr. Henshaw, respectively.

These two specimens, which evidently represent his original species, are *Paltodora* species and identical with 3. Zeller's type in Cambridge of *piscipellis*, and with 4. a specimen determined as *piscipellis* Zeller by Lord Walsingham, in U. S. National Museum.

Of the other species, bred from Solanum, I had 5. cotype and several other specimens, bred by Miss Murtfeldt, and it is identical with 6. a specimen in the U. S. National Museum determined and labeled by Lord Walsingham, *G. glochinella* Zeller, the description and figure of which also agree well with the specimens before me.

This species will be treated later under *Phthorimaea* Meyrick (p. 821), while the *similiella* Chambers=*piscipellis* Zeller should stand as *Paltodora*.

It is of value to note Chambers's suspicion¹ that he had two species mixed, as well as his note² that his *Gelechia ciliatulella*, which undoubtedly is a *Paltodora* species (p. 780), is only microscopically distinguishable from his "*Gelechia solaniella*," that is *similiella*.

It is a good species distinct from all at present described species nearest to *pallidella* Chambers, with which species it has the white-tipped scales in common.

Similiella was described from Kentucky, and Chambers's type in U. S. National Museum is from Texas, which is also the locality of Zeller's type of *piscipellis*.

Specimens in poor condition which I take to be this species were reared from flower heads of sunflower at the Insectary of U. S. Department of Agriculture, received from Mr. E. E. Bogue, Oklahoma.

This species has vein 6 and 7 of hindwing not only connate but in fact shortstalked.

PALTODORA TOPHELLA Walsingham.

Cleodora tophella WALSINGHAM, Insect Life, I, 1888, p. 83.—RILEY, Smith's List Lep. Bor. Am., No. 5519, 1891.

Paltodora tophella BUSCK, Dyar's List Amer. Lep., No. 5549, 1903.

U. S. National Museum possesses cotype, received from Lord Walsingham; also specimen collected at Beulah, New Mexico, 8,000 feet elevation by Prof. T. D. A. Cockerell.

Habitat.—California, New Mexico.

Veins 6 and 7 in hindwings are connate.

PALTODORA PALLIDELLA Chambers.

Cleodora pallidella CHAMBERS, Can. Ent., VI, 1874, p. 245; Bull. U. S. Geol. Surv., IV, 1878, pp. 92, 135.—WALSINGHAM, Insect Life, I, 1888, pp. 81, 82.—

RILEY, Smith's List Lep. Bor. Am., No. 5515, 1891.

Paltodora pallidella BUSCK, Dyar's List Amer. Lep., No. 5550, 1903.

¹ Bull. U. S. Geol. Surv., III, p. 143.

² Can. Ent., VI, p. 242.

As remarked by Lord Walsingham, it is evident that Chambers, when he amended and elaborated his first description had more than one species before him, and some of his statements are in direct contradiction to the original description.

I believe, from careful comparison with all the material at my disposal, that he had specimens of *magnella* Busck and *dietziella* Busck mixed up with his original species.

The only authentic type from Chambers in existence is the one mentioned by Lord Walsingham (but not known to him) in Miss Murtfeldt's collection. That is now in Professor Fernald's possession, and I have had the opportunity to examine it.

It is a plain looking, grayish yellow species with white-tipped scales, similar to those of *similiella* Chambers (*piscipellis* Zeller, p. 779) and *tophella* Walsingham., very near to the latter, but smaller, and of a lighter, more yellowish ground color.

I have recognized an identical specimen in the U. S. National Museum and in Dr. Dietz's collection from Colorado.

This type specimen bears Chambers' label and agrees well with his original rather meager description, but does not agree with his later detailed description of the supposed same insect. It is obviously, under the circumstances, proper to disregard these latter amendments which evidently applied to one or more distinct species, and to retain the name *pullidella* for the pale, nearly unmarked species represented by the unique type in Professor Fernald's collection.

Veins 6 and 7 of hindwing are closely approximated.

PALTODORA MODESTA Walsingham.

Cleodora modesta WALSHINGHAM, Insect Life, I, 1888, p. 82.—RILEY, Smith's List Lep. Bor. Am., No. 5517, 1891.

Paltodora modesta BUSCK, Dyar's List Amer. Lep., No. 5551, 1903.

Cotypes and other specimens of this small inconspicuous species from Los Angeles, California, are in the U. S. National Museum.

Hindwings with veins 6 and 7 connate.

SITOTROGA Heinemann.

Plate XXVIII, fig. 3.

Sitotroga HEINEMANN, Schmett. Deutschland und Schweiz, 1870, p. 287.

Basal joint of antennæ with long pecten. Labial palpi with second joints rough beneath; terminal joint longer than second, slender, pointed. Forewings very long, narrow, pointed, with 12 veins, 7 and 8 out of 6. Hindwings narrower than forewing, elongate trapezoidal, apex much produced, termen emarginate; 8 veins, 6 and 7 stalked; 2, 3, 4, and 5 remote parallel. Only the one cosmopolitan species is known.

SITOTROGA CEREALELA Olivier.

Sitotroga cerealella STAUDINGER and REBEL, Cat. Lep. Eur., II, No. 3902, 1901.—DIETZ, Smith's List Inse. N. Jersey, 1900, p. 475.—BUSCK, Dyar's List Amer. Lep., No. 5552, 1903.

Anacampsis cerealella GLOVER, U. S. Dept. Agr. Report, 1854, p. 67, pl. iv.

Gelechia cerealella CLEMENS, Proc. Phil. Acad., 1860, p. 168; Stainton ed. No. Am. Tin, 1872, pp. 112, 224.—PACKARD, Guide Study Inse., 1869, p. 350.—CHAMBERS, Bull. U. S. Geol. Surv., 1878, IV, p. 142.—RILEY, Smith's List Lep. Bor. Am., No. 5335, 1891.

This common species, the Angoumois moth, is often of economic importance on account of the injuries of the larva to stored grain.

I have not attempted to give the very numerous references to the economic literature of the species.

AUTONEDA, new name.

Plate XXVIII, fig. 4.

Neda CHAMBERS, Can. Ent. VI, 1874, p. 243.

The name *Neda* being preoccupied in the Coleoptera, I propose the above modification to signify the genus which Chambers described¹ with *plutella* as type.

It has the following characters: Labial palpi, like those in *Ipso-lophus*; second joint with large, dense, projecting tuft on under side; terminal joint erect, pointed, as long as second joint; forewings narrow, nearly lanceolate; 12 veins; veins 7 and 8 stalked to costa; 6 separate, but very approximate to 7; hindwings under I; apex produced termen emarginate; 8 veins, all separate; 6 and 7 somewhat approximate; 5 nearer 6 than 4.

At present only the one species is known.

AUTONEDA PLUTELLA Chambers.

Neda plutella CHAMBERS, Can. Ent., 1874, p. 244; Can. Ent., VII., 1875, p. 105; Bull. U. S. Geol. Surv., 1878, IV., p. 157.—RILEY, Smith's List Lep. Bor. Am., No. 5521, 1891.

Autoneda plutella BUSCK, Dyar's List Amer. Lep., No. 5553, 1902.

Type.—No. 468, U.S.N.M., with Chambers' label on the pin, agrees with his unusually accurate and complete generic and specific descriptions, and is identical with other types, also labeled by Chambers himself, in the Museum of Comparative Zoology at Cambridge. One of these bears Lord Walsingham's blue label, No. 979, corresponding with his identification in his notebook,² *Neda plutella*.

These types all undoubtedly represent this interesting species.

They are all from Kentucky.

¹Can. Ent., VI, 1874, p. 243.

²Mentioned on p. 768.

GLAUCE Chambers.

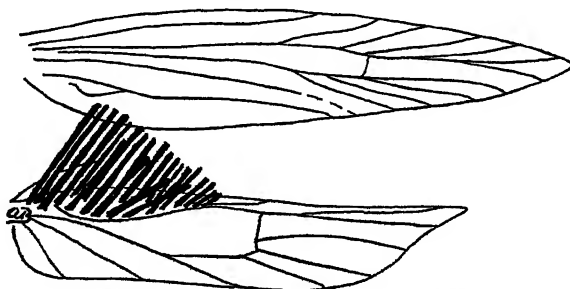
Glauce CHAMBERS, Can. Ent., VII, 1875, p. 11.

Labial palpi long, recurved, overarching the vertex; second joint slightly thickened with scales; terminal joint nearly as long as second, pointed.

Forewings elongate ovate, pointed; 12 veins, 7 and 8 out of 6; hindwings nearly as broad as forewings, trapezoidal; apex produced, pointed; termen sinuate; 8 veins, 6 and 7 stalked, 3 and 4 separate, 5 nearest 4; the costal margin from base to the middle is armed with a row of large, stiff, sharp, two-edged bristles.

Only the following species is known:

GLAUCE PECTENALÆELLA Chambers.



VENETIAN OF GLAUCE PECTENALÆELLA—CHAMBERS.

Glauce pectenalella CHAMBERS, Can. Ent., VII, 1875, p. 12; Bull. U. S. Geol. Surv., IV, 1878, p. 148; Journ. Cinn. Soc. Nat. Hist., II, 1880, p. 203, fig. 22.—RILEY, Smith's List Lep. Bor. Am., No. 5291, 1891.—BUSCK, Dyar's List Amer. Lep., No., 5642, 1903.

This characteristic species, all authentic material of which is lost, I have recently recognized beyond doubt among Tineinæ collected by the writer at light in the District of Columbia and in the neighborhood of Covington, Kentucky.

Chambers's description and figure of the wing is essentially correct, except that he has made vein 6 in forewing out of vein 7, instead of 7 and 8 out of 6, an easily explained error.

Chambers's type came from Texas.

TELPHUSA Chambers.

Plate XXVIII, fig. 5.

Telphusa CHAMBERS, Can. Ent., IV, 1872, p. 182;
Xenolechia MEYRICK, Handbook Brit. Lep., 1895, p. 583.

Chambers erected this genus for his species *curvistrigella*, the unique type of which is still in the Museum of Comparative Zoology in Cambridge, with Chambers' label on the pin, and recognizable, though in poor condition.

Chambers shortly afterwards gave up this genus and included his species in *Gelechia* as a synonym of Clemen's *Gelechia longifusciella*, but a name is needed to signify the genus, which Chambers can hardly be said to have defined, but which has the following characters in common with *curvistrigella*. Chambers' name must stand in preference to Meyrick's later name *Xenolechia*.

I strongly suspect that Chambers' genus, *Adrasteia*, is synonymous with the present genus, in which case that name would supplant *Telphusa*, but for the time being it must be left as "unrecognized." The types of the two species, *Adrasteia alexandriella* and *A. fusciella*,¹ on which Chambers erected the genus, are lost, and though I feel rather certain that I have recognized both species as belonging to *Telphusa*, still altogether insufficient collecting has been done in Kentucky, from where these species are described, to warrant final conclusions from the limited material on hand, and at present I must leave both genus and species as unrecognized. There is no way to include the genus in any table, as Chambers did little more than attach the name to those two species without further specification; the only tangible generic character given is the tufted forewings.

Telphusa has the following characters: Second joint of labial palpi thickened with rough scales beneath, terminal joint slender pointed.

Forewings elongate pointed, 12 veins, 7 and 8 stalked, 6 separate or out of 7 near base; hindwings trapezoidal, apex pointed termen sinuate, as broad or broader than the forewings; 8 veins, 6 and 7 stalked, 3 and 4 separate, 5 nearest 4. Forewings often with tufts of raised scales.

The American species at present recognized as belonging to this genus may be separated by the following table:

With oblique light fascia at basal fourth of forewings	1
Without such light fascia	2
1. Forewings with apical half of dorsal edge white	<i>longifusciella</i> , p. 785
Dorsal edge not white	<i>lufifusciella</i> , p. 783
2. Ground color of forewings white	3
Ground color not white	5
3. Markings on forewings black	4
Markings fawn colored	<i>betulella</i> , p. 787
4. With complete black fascia crossing forewings	<i>basistrigella</i> , p. 787
Black fascia not reaching dorsal edge	<i>basifusciella</i> , p. 787
5. Wings very dark fuscous, nearly black	<i>quinquecostatella</i> , p. 785
Wings lighter, gray	6
6. With oblique black streak from costa near base	7
Without such streak	8
7. Head and thorax dark fuscous	<i>quereinigracella</i> , p. 786
Head and thorax light brownish	<i>palliderosacella</i> , p. 786
8. Forewings with raised scales	<i>querciella</i> , p. 787
Forewings without raised scales	9
9. With sharply defined dark spot on disc	<i>glaucliferella</i> , p. 788
Without such spot	<i>belangerella</i> , p. 788

¹ Can. Ent., IV, 1872, p. 149.

TELPHUSA LONGIFASCIELLA Clemens.

Gelechia longifasciella CLEMENS, Proc. Ent. Soc. Phila., II, 1863, pp. 12, 121; Stainton, Tin. N. A., 1872, pp. 219, 223.—CHAMBERS, Can. Ent., IV, 1872, p. 174; Bull. U. S. Geol. Surv., IV, 1878, p. 144.—RILEY, Smith's List Lep. Bor. Am., No. 5402, 1891.

Telphusa curvistrigella CHAMBERS, Can. Ent., IV, 1872, p. 133.

Gelechia obliquifasciella CHAMBERS, Journ. Cinn. Soc. Nat. Hist., II, 1879, p. 182.—RILEY, Smith's List Lep. Bor. Am., No. 5421, 1891.

Telphusa longufasciella BUSCK, Dyar's List Amer. Lep., No. 5554, 1902.

Chambers dropped *curvistrigella* as a synonym of Clemens's *longifasciella*.

In the Museum of Comparative Zoology in Cambridge are types of *curvistrigella* and *obliquifasciella* with Chambers's handwriting. They are identical, as the description would indicate, and Chambers has here again evidently been a victim of his own carelessness with his types.

I have met with no other specimens.

Habitat.—Texas, Kentucky.

TELPHUSA QUINQUECRISTATELLA Chambers.

Gelechia quinquecristatella CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, pp. 88, 146.—RILEY, Smith's List Lep. Bor. Am., No. 5465, 1891.

Telphusa quinquecristatella BUSCK, Dyar's List Amer. Lep., No. 5555, 1903.

The specimens in the U. S. National Museum, determined by Lord Walsingham as *Gelechia quinquecristatella* Chambers, agree with Chambers's description and undoubtedly represent this species.

I am unable to distinguish it from authentic specimens (unfortunately poor) of the European (*Xenolechia*) *æthiops* Westwood, and I sent specimens to Dr. E. Meyrick, who also identified it as this species.

However, the European food-plant of *æthiops*, *Erica cinerea*, does not grow wild in this country, and until the species has been bred here there is a possibility that it is another, closely related species, and it will be safer to retain it as such until then; but the imagoes are surely very similar.

Habitat.—Eastern United States.

TELPHUSA LATIFASCIELLA Chambers.

Gelechia latifasciella CHAMBERS, Cinn. Quart. Jour., II, 1875, p. 251; Bull. U. S. Geol. Surv., IV, 1878, p. 144.—RILEY, Smith's List Lep. Bor. Am., No. 5899, 1891.

Telphusa latifasciella BUSCK, Dyar's List Amer. Lep., No. 5556, 1903.

I have examined types in Professor Fernald's collection and in the Museum of Comparative Zoology in Cambridge. In the National Museum are specimens received from Miss Murtfeldt, who writes that she has bred both the light and the dark forms from similar larvæ.

in rolled leaves of oak. I have taken a few specimens from around Washington, District of Columbia.

Habitat.—Kentucky, Missouri.

TELPHUSA QUERCINIGRACELLA Chambers.

Gelechia quercinigracella CHAMBERS, Can. Ent., IV, 1872, p. 170.

Gelechia (*Poecilia*?) *fragmentella* ZELLER, Verh. k. k. zool.-bot. Gesell. Wien, XXIII, 1873, p. 71.—CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 143.—

RILEY, Smith's List Lep. Bor. Am., No. 5365, 1891.

Gelechia quercinigracella CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 146.—

RILEY, Smith's List Lep. Bor. Am., No. 5460, 1891.

Telphusa quercinigracella BUSCK, Dyar's List Amer. Lep., No. 5557, 1903.

Placed by mistake among the types of *Gelechia* (*Recurvaria*) *quercivorella* Chambers in the Museum of Comparative Zoology in Cambridge, and therefore omitted in Hagen's list of types¹, I found a specimen differing from the others and labeled in Chambers's handwriting *G. quercinigracella*.

This specimen agrees perfectly with Chambers's description, and without doubt represents this species. It is, so far as I know, the only authentic specimen of this species from Chambers in existence.

It is, as the descriptions would indicate, identical with Zeller's type of *fragmentella*, also found in the Museum of Comparative Zoology. Both are females.

In the U. S. National Museum there is a good series of this species bred by the writer from larvæ on oak, agreeing well with Chambers's description of the larva.

Habitat.—Texas, Kentucky, District of Columbia, and New York.

TELPHUSA PALLIDEROSACELLA Chambers.

Gelechia (*Ergatis*) *palliderosacella* CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, pp. 90 and 145.—WALSINGHAM, Trans. Am. Ent. Soc. Phila., X, 1882, p. 180.—RILEY, Smith's List Lep. Bor. Am., No. 5440, 1891.

Telphusa palliderosacella BUSCK, Dyar's List Amer. Lep., No. 5558, 1903.

In the U. S. National Museum there are specimens determined by Lord Walsingham which I believe truly represent this species. I have received similar specimens from Miss Murtfeldt under that name, which agree with Chambers's description.

Food plant.—Oak.

Habitat.—Texas, Missouri, District of Columbia, Pennsylvania, and New York.

What has been supposed to be a type of *palliderosacella* with Chambers's label on the pin is found in the Museum of Comparative Zoology in Cambridge, but it does not agree with his description and some mistake has obviously been made; it is a much rubbed *Aristotelia* of the *roseosuffusella* group.

¹ Papilio, IV, 1884, p. 98.

TELPHUSA QUERCIELLA Chambers.

Depressaria querciella CHAMBERS, Can. Ent., IV, 1872, pp. 127, 147.

Adraستا querciella CHAMBERS, Can. Ent., IV, 1872, p. 207.

Gelechia querciella CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 146.—RILEY, Smith's List Lep. Bor. Am., No. 5463, 1891.—DIETZ, Smith N. J. Insects, 1900, p. 474.

Telphusa querciella BUSCK, Dyar's List Amer. Lep., No. 5559, 1903.

Type No. 460, U.S.N.M., of this species, agrees with other specimens from Chambers in Professor Fernald's collection and in the Museum of Comparative Zoology in Cambridge. I have met with no other specimen.

Food plant.—Oak (Chambers).

Habitat.—Kentucky, New Jersey.

TELPHUSA BASISTRIGELLA Zeller.

Gelechia (Pecilia) basistrigella ZELLER, Verh. k. k. zool.-bot. Gesellsch. Wien, 1873, p. 270, pl. LV, fig. 23.

Gelechia basistrigella CHAMBERS, Bull. U. S. Geol. Surv., IV, 1870, p. 141.—RILEY, Smith's List Lep. Bor. Am., 5318, No. 1891.

Telphusa basistrigella BUSCK, Dyar's List Amer. Lep., No. 5560, 1903.

The unique type of this species is in the Museum of Comparative Zoology in Cambridge in good condition. I have not seen other specimens which I can refer with certainty to this species.

Habitat.—Texas.

TELPHUSA BASIFASCIELLA Zeller.

Gelechia (Pecilia) basifasciella ZELLER, Verh. k. k. zool.-bot. Gesellsch. Wien, 1873, p. 269, pl. III, fig. 22.

Gelechia basifasciella CHAMBERS, Bull. U. S. Geol. Surv., IV., 1878, p. 141.—RILEY, Smith's List Lep. Bor. Am., No. 5319, 1891.—DIETZ, Smith's List Insects N. J., 1900, p. 474.

Telphusa basifasciella BUSCK, Dyar's List Amer. Lep., No. 5561, 1903.

I have examined the types of this easily recognized species in the Museum of Comparative Zoology in Cambridge. In the U. S. National Museum there is a specimen identical with these determined by Lord Walsingham.

Habitat.—Texas, New Jersey (Dietz).

TELPHUSA BETULELLA, new species.

Telphusa betulella BUSCK, Dyar's List Amer. Lep., No. 5562, 1903.

Antennæ $\frac{3}{4}$, simple, slightly serrate toward tip, light reddish, with base of each joint silvery white and tip of each joint dark brown.

Labial palpi, second joint thickened, with rough scales beneath, silvery white slightly sprinkled with drap scales and with base drap; terminal joint suffused with drap and black scales, a small spot on the inner side near the middle and the extreme tip whitish. Face and

head light silvery drap, thorax a shade darker. Forewings silvery white suffused irregularly with drap scales, especially below fold and in the apical part; extreme base of costa black; at middle of wing a small dark drap costal spot; near base of wing, just below costa, a large tuft of raised scales; on middle of fold, at end of disk and beyond disk, are similar smaller tufts of raised scales, not very conspicuous and of the general color of the wing, white and drap mixed.

In apical part and at base of the cilia a few scattered black scales; cilia whitish.

Hindwing light silvery gray, cilia golden white. Abdomen and legs golden white, slightly sprinkled with drap. Venation typical; veins 6 and 7 in hindwing very shortly stalked.

Alar expanse.—12 to 13 mm.

Habitat.—District of Columbia, Virginia.

Food plant.—*Betula nigra*.

Type.—No. 6348, U.S.N.M.

Described from several specimens bred in March, 1884, by Mr. Th. Pergande, and in August, 1899, by the writer.

The larvæ are leaf rollers on black birch and pupate in the leaf. Imago appear during August and another brood overwinters as pupa, producing adults in early spring.

TELPHUSA BELANGERELLA Chambers.

Gelechia belangerella CHAMBERS, Can. Ent., VII, 1875, p. 210; Bull. U. S. Geol. Surv., IV, 1878, p. 141.—RILEY, Smith's List Lep. Bor. Am., No. 5320, 1891.

Gelechia (Teleia) oronella WALSHINGHAM, Trans. Am. Ent. Soc. Phila., X, 1882, p. 179.

Gelechia oronella PACKARD, Fifth Rep. U. S. Ent. Comm., 1890, p. 630.—RILEY, Smith's List Lep. Bor. Am., No. 5436, 1891.

Gelechia orella DIETZ, Smith's List Ins. N. Jersey, 1900, p. 474.

Telphusa belangerella BUSCK, Dyar's List Amer. Lep., No. 5563, 1903.

The unique well-preserved type of *Gelechia belangerella* was obtained from Laval University, Quebec, and is now in the U. S. National Museum under type No. 5767. In that collection are also specimens compared by the writer with Walsingham's type of *Gelechia oronella* in Professor Fernald's collection.

As the description would indicate the two species are identical. Chambers name must stand. Larva is leaf roller on alder (Packard).

Habitat.—Eastern United States, Canada.

TELPHUSA GLANDIFERELLA Zeller.

Gelechia (Anacampsia) glandiferella ZELLER, Verh. k. k. zool.-bot. Gesellsch. Wien, XXIII, 1873, p. 275, pl. iv; fig. 25.

Gelechia sella CHAMBERS, Can. Ent., VI, 1874, p. 238.

Gelechia glandifuella CHAMBERS, Can. Ent., IX, 1877, p. 14.

Gelechia glandifera CHAMBERS, Can. Ent., IX, 1877, p. 24.

Gelechia glandiferella CHAMBERS, U. S. Geol. Surv. Bull., IV, 1878, p. 144.—RILEY, Smith's List Lep. Bor. Am., No. 5382, 1891.

Xenolechia glandiferella WALSHINGHAM, Proc. Zool. Soc. London, 1897, p. 72.

Telphusa glandiferella BUSCK, Dyar's List Amer. Lep., No. 5564, 1903.

In the U. S. National Museum are types of both Zeller's and Chambers's species. I have also examined the types of both in the Museum of Comparative Zoology. They all represent the form figured by Zeller, with the large wing spot reaching down to the dorsal edge.

Chambers mentioned a variety in which this spot is represented by a triangular spot on the fold, not reaching the margin. This supposed variety is also represented in the National Museum, labeled by Lord Walsingham *Gelechia glandiferella*. I am inclined to believe it a quite distinct species, but until its life history is known it may remain under the present species.

Riley made *pallidocherella* Chambers a synonym of this species, but, as I have shown,¹ this is a mistake. Chambers described only two species as *pallidocherella*, the one is type of *Helice* [p. 804], and probably is the one confounded with the above; the other is a *Gnorimoschema* [p. 828].

AGNIPPE Chambers.

Plate XXVIII, figs. 6-7.

Agnippe CHAMBERS, Can. Ent., IV, p. 194.

Labial palpi long curved; second joint slightly thickened, with rough scales beneath toward apex, terminal joints smooth pointed, nearly as long as second.

Forewings elongate ovate, pointed; 10 or 11 veins; vein 11 absent; vein 5 absent or out of 4, 7 and 8 out of 6. Hindwings slightly broader than forewings; trapezoidal apex pointed; termen sinuate; 7 veins, 6 absent; 2, 3, 4, and 4 separate, equidistant; cell open between 5 and 7.

Only two species are at present recognized, which may be separated thus:

Vein 5 in forewing, present; head brownish, *biscolorella*, p. 789.

Vein 5 in forewing, absent; head white, *fuscopulvella*, p. 790.

AGNIPPE BISCOLORELLA Chambers.

Agnippe biscolorella CHAMBERS, Can. Ent., IV, 1872, p. 195; V, 1873, p. 230; VII, 1875, p. 106; IX, 1877, p. 231; Bull. U. S. Geol. Surv., IV, 1878, p. 128.—RILEY, Smith's List. Lep. Bor. Am., No. 5296 [part], 1891.—BUSCK, Dyar's List. Amer. Lep., No. 5567, 1903.

Type No. 442, in the U. S. National Museum, of the species, is identical with type in Professor Fernald's collection and types in the Museum of Comparative Zoology, and agrees perfectly with Chambers's generic and specific description.

The synonymy with the following species, which Chambers himself suggested, will not stand as explained under that species.

Food plant.—Chambers surmised¹ that this species fed in some way on *Gleditschia triacanthos* (honey locust), but nothing definitely is known of the early stages.

Habitat.—Kentucky.

AGNIPPE FUSCOPULVELLA Chambers.

Agnippe fuscopulvella CHAMBERS, Can Ent., IV, 1872, p. 195.—BUNCK, Dyar's List Amer. Lep., No. 5568, 1903.

Agnippe biscolorella CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 128.

Agnippe biscolorella var. *fuscopulvella* RILEY, Smith's List Lep. Bor. Am., No. 5296a, 1891.

Though at first recognizing this as a distinct species, Chambers was led later by the superficial similarity to make it a synonym of the foregoing species.

In the U. S. National Museum, however, is, besides the type of *biscolorella*, another specimen received from Chambers at the same time as this. It is in Chambers's mounting and furnished with an identical small label and the number 7, as is found on the pin of *biscolorella*. But it is a different, though very similar insect, which agrees well with Chambers's description of *fuscopulvella*, and which I feel confident is the original type of that species. This view was substantiated during a study of Chambers's types in the Museum of Comparative Zoology in Cambridge, where types of both species, correctly named by Chambers himself, were found.

A superficial examination might bring the conclusion, as it did to Chambers, that *fuscopulvella* is a worn specimen, or a variety of *biscolorella*, but when closely examined it is easily seen that the dirty whitish ground color in *fuscopulvella*, which gives the appearance of a worn wing, really is intact and suits Chambers's description of *fuscopulvella* well.

And a study of the venation will show that though very similar to that of *biscolorella* it differs in lacking vein 5 on the forewings.

All other points in venation, form of wing, and palpi are identical with those of the type of the genus, the definition of which I have therefore only widened in that one respect.

Habitat.—Kentucky.

NEALYDA Dietz.

Plate XXVIII, fig. 8.

Nealyda DIETZ, Ent. News, XI, 1900, p. 350; Proc. U. S. Nat. Mus., XXIII, 1900, p. 228.

Labial palpi moderate, curved, ascending, smooth, second joint

¹ Can Ent., IX, p. 231.

slightly thickened with appressed scales; terminal joint shorter than second, also somewhat thickened with scales, pointed. Forewings ovate, pointed, with very heavy scaling, making them appear proportionately broader; 12 veins, 7 and 8 stalked. Hindwings under I, trapezoidal; apex produced; termen so deeply emarginate as to make wing bilobed; 6 veins, 5 and 6 absent, 7 to apex cell open between 4 and 7.

The larvæ are leaf miners; they are flattened, suggesting *Lithocolletis* larvæ of the flat type; abdominal legs on segments 7–10 long, thin, with globular swelling at the end; no anal feet; they pupate in flat cocoons outside the mine.

Only three species are at present known, but that more remain to be discovered is proven by the supposed type of *Gelechia grisse-fusciella* Chambers, in the Museum of Comparative Zoology in Cambridge, which is an undescribed species of *Nealyda*.

The described species may be separated as follows:

1. Dark fascia sharply defined on both sides.....*pisoniæ*, p. 791
2. Dark fascia not sharply defined toward the base of wing..... 3
3. Labial palpi dark; both joints tipped with white.....*bifidella*, p. 791
- Labial palpi light, not tipped with white.....*kinzelella*, p. 792

NEALYDA PISONIÆ Busck.

Nealyda pisoniæ Busck, Proc. U. S. Nat. Mus., XXIII, 1900, p. 229, pl. 1, fig. 5.—DYAR, Proc. Wash. Ent. Soc., IV, 1901, p. 470.—Busck, Dyar's List Amer. Lep., No. 5569, 1902.

Types of male and female are found in the U. S. National Museum (No. 4935).

Larva makes large trumpet-formed upper mine in leaves of *Pisonia aculeata*.

Habitat.—Palm Beach, Florida.

NEALYDA BIFIDELLA Dietz.

Nealyda bifidella Dietz, Ent. News, XI, 1900, p. 351, pl. 1, fig. 2.—Busck, Proc. U. S. Nat. Mus., XXIII, 1900, p. 228.—DYAR, Proc. U. S. Nat. Mus., XXV, 406, 1902.—Busck, Dyar's List Amer. Lep., No. 5570, 1903.

In the U. S. National Museum is a cotype received from Dr. Dietz; also a large series of perfect specimens bred by Dr. Dyar and the writer from material collected by Dr. Dyar at Salida, Colorado, in July, 1901.

The larva works as leaf miner in the identical manner as the two other species, and has the same strange form and development of the abdominal legs; anal legs absent.

Food plant.—*Allionia nictaginea*.

Habitat.—Colorado.

NEALYDA KINZELELLA Busck.

Nealyda kinzelella BUSCK, Proc. U. S. Nat. Mus., XXIII, 1900, p. 230; Dyar's List Amer. Lep., No. 5571, 1903; DYAR, Proc. Ent. Soc. Washington, IV, p. 471, 1901.

Types are in U. S. National Museum (No. 4936).

Larva is leaf miner on *Pisonia obtusata*.

Habitat.—Palm Beach, Florida.

CHRYSOPORA Clemens

Plate XXIX, fig. 9.

Chrysopora CLEMENS, Proc. Acad. Nat. Sci. Phila., 1860, p. 362.

Nomia CLEMENS, Proc. Acad. Nat. Sci. Phila., 1860, p. 167.

Nannodia HEINEMANN, Schmetterlinge Deutschland und der Schweiz, 1870, p. 284.

Labial palpi moderate, curved smooth, thin pointed, terminal joint shorter than second joint. Forewings narrow, ovate, pointed; 12 veins, 7 and 8 stalked, 6 separate. Hindwing under I; apex greatly produced; hind margin deeply and circularly excavated beneath it and anal angle rounded; 7 veins, 6 absent, cell not closed, 5 nearly obsolete approximate to 4, 3 and 4 separate.

This genus, of which *lingulacella* Clemens is the type, seems a development from *Aristotelia*, and forms an interesting step toward the extreme form of hindwings as found in the foregoing genus *Nealyda* Dietz.

The larvæ, as far as known, are leaf miners on *Atriplex* and *Chenopodium*.

Only the following two species are at present recognized from America:

With uninterrupted silvery fascia before middle of forewing *hermonella*, p. 793
Silvery fascia interrupted at the fold *lingulacella*, p. 792

CHRYSOPORA LINGULACELLA Clemens.

Nomia lingulacella CLEMENS, Proc. Acad. Nat. Sci. Phila., 1860, p. 167; Stainton Ed. Nor. Am. Tin., 1872, p. 124.

Chrysopora lingulacella CLEMENS, Proc. Acad. Nat. Sci. Phila., 1860, p. 362; Stainton Ed. Nor. Am. Tin., 1872, p. 158.—BUSCK, Dyar's List Amer. Lep., No. 5572, 1903.

Gelechia hermonella CHAMBERS, Can. Ent., IV, 1872, pp. 67 and 169; Ent. Mo. Mag., XI, 1875, p. 279; Bull. U. S. Geol. Surv., IV, 1878, pp. 117 and 144; Can. Ent., X, 1878, p. 52.—RILEY, Smith's List Lep. Bor. Am., No. 5393, 1891.

Chrysopora lingulacella CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 134.

Gelechia hermonella CHAMBERS, Can. Ent., IV, 1878, p. 173.

Gelechia armenella FARR and BOLL, Stett. Ent. Zeit., XXXIX, 1878, p. 249.—RILEY, Smith's List Lep. Bor. Am., No. 5314, 1891.

Clemens's type of this species is lost, but there is no difficulty in identifying this striking insect from his careful description.

It is the same species which Chambers, judging from Stainton's figure of that species, persistently but wrongfully identified as *hermanella* Fabricius, although he himself noticed several differences from this European species, both in the larva and in the imago.

The similar life mode and the common food plant of these two species, together with the great resemblance in coloration, made this mistake very natural.

Frey, who was acquainted with the European *hermanella* in nature, distinguished between the two and described the American species as *Gelechia armeniella*, not recognizing that it had already been described by Clemens, a fact which Chambers afterwards realized and brought out in his index, still, however, clinging to his belief that it was nothing but a variety of *hermanella*.

Chambers, writing on this species, said that he first found the true *hermanella* at Lake Michigan, and afterwards what he called the variety in Kentucky. This may be possible, but all evidence indicates that he was mistaken in his first determination, and that it was *Chrysopora lingulacella* bred from *Chenopodium album*. His notes on differences in larva and imago from Stainton's figure of *hermanella* indicate this.

In all events, I have examined all existing specimens, determined by Chambers in the United States National Museum, in the Museum of Comparative Zoology in Cambridge, and in Professor Fernald's collection. They are all alike and represent Clemens's species.

Food plant.—*Chenopodium* and *Atriplex*.

Habitat.—Michigan, Kansas, Kentucky, Missouri, Pennsylvania, District of Columbia.

CHRY SOPORA HERMANELLA Fabricius.

Ainea hermanella FABRICIUS, Species Insectorum, II, 1781, p. 509.

Chrysopora hermanella STAUDINGER and REBEL, Cat. Lep. Eur., II, No. 2896, 1901.—

BUSCK, Dyar's List Amer. Lep., No. 5573, 1903.

I have seen only a single specimen of this species from America; the one sent me for determination from Laval University, Quebec, Canada. The U. S. National Museum contains a fine series of European specimens.

LEUCE Chambers.

Plate XXIX, fig. 10.

Nera CHAMBERS, Can. Ent., VII, 1875, p. 9.

Leuce CHAMBERS, Can. Ent., VII, 1875, p. 51.

Labial palpi rather short, second joint thickened with large tuft beneath; terminal joint shorter than second, thickened with appressed scales, blunt. Forewings elongate, ovate, pointed; 12 veins, 7 and 8 stalked, 3 and 4 connate from corner of cell, 2 distant, long; with tufts of raised scales. Hindwing less than 1 trapezoidal, apex produced,

termen sinuate, anal angle rounded; 8 veins, 6 and 7 parallel, 3 and 4 closely approximate, 5 nearest 4.

The genus was placed by Riley in the Laverniæ in Smith's List Lep. Bor. Am., probably on account of Chambers's mistake in re-describing the type as *Laverna fuscocristatella*. This, however, Chambers himself corrected, and his description as well as his types prove that it belongs to the *Gelechiidæ*. Only the one species is at present recognized.

LEUCE FUSCOCRISTATELLA Chambers.

Nera fuscocristatella CHAMBERS, Can. Ent., VII, 1875, p. 9, Bull. U. S. Geol. Surv., IV, 1873, p. 157.

Laverna fuscocristatella CHAMBERS, Can. Ent., VII, 1875, p. 34.

Leuce fuscocristatella CHAMBERS, Can. Ent., VII, 1875, p. 51.—RILEY, Smith's List Lep. Bor. Am., No. 5740, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5574, 1903.

Anarsia (?) *belfragesella* CHAMBERS, Journ. Cinn. Soc. Nat. Hist., II, 1879, p. 183.—RILEY, Smith's List Lep. Bor. Am., No. 5542, 1891.

Type No. 495 in the U. S. National Museum of *Nera fuscocristatella* is identical with the type of this species in Professor Fernald's collection and types in the Museum of Comparative Zoology.

They agree well with the description, and are all authenticated by Chambers's handwriting on the labels.

Anarsia ? *belfragesella* is another name for this species, as Chambers's descriptions and his authentic type in the museum in Cambridge prove.

All of these types are from Texas. I have met with no other specimen.

ARISTOTELIA Hübner.

Plate XXIX, fig. 11.

Aristotelia HÜBNER Verz. bek. Schm., 1818, p. 424.

Eucloptus WALSINGHAM, Proc. Zool. Soc. Lond., 1897, p. 69.

Labial palpi long, slender, curved; second joint thickened with appressed scales, somewhat roughened beneath; terminal joint long, smooth, pointed.

Forewings narrow, elongate, pointed; 12 veins, 7 and 8 stalked. Hindwings as broad or nearly as broad as forewings, elongate trapezoidal, apex produced, pointed, termen emarginate; 8 veins, all separate, 3, 4, and 5 remote from each other, 6 and 7 parallel.

Lord Walsingham has separated,¹ under the generic name *Eucloptus*, such species of this genus in which the males have a costal hair pencil from base of hindwing. I can not, however, believe that this is a good generic character and that *Eucloptus* should be retained as

¹ Proc. Zool. Soc. Lond., 1897, p. 69.

a good natural genus. That character¹ is found in several genera, and very closely allied species are found differing in the presence or absence of this hair pencil, while others, evidently farther apart, would go together on account of the possession of it.

Miss Murtfeldt's species *Eucatyptus striatella*,² however, can not be included in that genus, and consequently not in the present, as it has veins 3 and 4 in hindwings connate and also differs in palpal characters. It belongs to Meyrick's recent genus *Phthorimæa*, under which it will be treated.

Of the species included in *Aristotelia* by Dr. Dietz,³ *pinifoliella* Chambers will be found treated under *Paralechia* Busck, *attributella* under *Epithectis* Meyrick, and *dorsivittella* under *Recurvaria* Haworth.

The species at present recognized belonging to this genus may be separated thus:

Forewings, unicolorous, or nearly so	1
Forewings, not unicolorous	7
1. Ground color light, white, or yellowish.....	2
Ground color dark, black, or fuscous.....	5
2. Forewings with five black discal dots.....	<i>quinquepunctella</i> , p. 804
Forewings without such five dots	31
3. With light yellow costal streak at beginning of cilia.	4
Without such streak	<i>discomotella</i> , p. 802
4. Tip of terminal joint of labial palpi black	<i>kearfottella</i> , p. 803
Tip of labial palpi not black.....	<i>gileollinella</i> , p. 803
5. Antennæ with fifth and tenth apical joint white above.....	<i>absconditella</i> , p. 801
Antennæ without white joints	6
6. Face creamy yellow	<i>physaliella</i> , p. 802
Face dark	<i>minimella</i> , p. 802
7. With metallic markings	8
Without metallic markings	10
8. Basal two-thirds of forewing light yellow.....	<i>cockerella</i> , p. 800
Basal two-thirds of forewing not yellow	9
9. With row of black discal dots.....	<i>elegantella</i> , p. 799
Without such row of dots.....	<i>argentifera</i> , p. 800
10. Forewings with dark fascia at apical third	11
Without such fascia	12
11. Head and thorax light yellow.....	<i>bifuscella</i> , p. 799
Head and thorax dark	<i>molestella</i> , p. 797
12. Forewings more or less roseate.....	13
Forewings not roseate	<i>ivæ</i> , p. 799
13. With pure white costal markings	<i>roseusuffusella</i> , p. 796
Without pure white costal markings	14
14. Males with costal hair pencil at base of hindwing.....	<i>rubidella</i> , p. 798
Males without such hair pencil.....	5
15. Extreme apex of third joint of labial palpi black.....	<i>pubibundella</i> , p. 796
Apex not black	<i>fungivorella</i> , p. 798

¹This hair pencil is of an entirely other and less important nature than the one found in the genus *Phthorimæa* Meyrick (p. 821), where the wing itself is modified for its reception.

²Can. Ent., XXXII, 1900, p. 163.

³Smith's List of New Jersey Insects, 1900.

ARISTOTELIA ROSEOSUFFUSELLA Clemens.

Gelechia roseosuffusella CLEMENS, Proc. Acad. Nat. Sci. Phila., XII, 1860, pp. 162, 434; Proc. Ent. Soc. Phila., II, 1863, p. 121; Proc. Ent. Soc. Phila., III, 1864, p. 508; Stainton Ed. Tin. N. Am., 1872, pp. 40, 113, 225, 262.—CHAMBERS, Can. Ent., IV, 1872, pp. 69, 148, 169, 193; Bull. U. S. Geol. Surv., III, 1877, pp. 125, 141; Can. Ent., IX, 1877, p. 14; Bull. U. S. Geol. Surv., IV, 1878, pp. 110, 146; Journ. Cinn. Soc. Nat. Hist., II, 1880, p. 183.—MURTFELDT, Can. Ent., VI, 1874, p. 222; Bull. U. S. Dept. Agr. Div. Ent., 1891, pp. 23, 53.—RILEY, Smith's List Lep. Bor. Am., No. 5470, 1891.

Gelechia rosasuffusella CHAMBERS, Cinn. Quart. Journ. Sci., II, 1875, p. 290.

Gelechia (Ergatis) roseosuffusella ZELLER, Verh. k. k. zool.-bot. Gesell. Wien, XXIII, 1872, p. 272, pl. IV, fig. 24.—WALSINGHAM, Trans. Am. Ent. Soc., X, 1882, p. 180.

Gelechia bellula WALKER, Cat. Lep. Ins. Brit. Mus., XXIX, 1864, p. 595.

Aristotelia roseosuffusella WALSINGHAM, Proc. Zool. Soc. Lond., 1897, p. 66 —DIETZ, Smith's List N. Jers. Insects, 1900, p. 474.—BUSCK, Proc. U. S. Nat. Mus., XXIII, 1900, p. 226; Dyar's List Amer. Lep., No. 5575, 1903.

There is great need of careful observations on and breeding of this and the several closely allied species. To Miss Mary Murtfeldt is due what has been done already in this direction in this group, and without her records we should be still more at sea than now is the case.

What I provisionally, in common with Miss Murtfeldt and Lord Walsingham, take to be this species is the same as Zeller held to be *roseosuffusella*, as is shown by Zeller's authentic specimens in Cambridge and in the U. S. National Museum. It is also what Chambers and Riley thought to be the species, as is shown by the specimens determined by them. This species breeds in *Trifolium pratense* and is common all over the continent and is also found in the West Indies.

But Clemens says expressly that *roseosuffusella* feeds in the fruit panicles of sumach.¹

It is unlikely that the species has both food plants. I have endeavored during the last years to breed all Micro-lepidoptera found on sumach with this particular question in view, but have not met with any which belong in this group.

Clemens made his statement about the food plant four and a half years after his description of the insect, and has possibly made a mistake somehow; but if ever a *Gelechiid* answering his description is bred from sumach, it must of course retain Clemens's name and a new name must be provided for the *Trifolium* feeder.

In the U. S. National Museum are two specimen named by Zeller, one labeled by Chambers, and three by Lord Walsingham, besides numerous specimen from many different localities.

ARISTOTELIA PUDIBUNDELLA Zeller.

Gelechia (Ergatis) pudibundella ZELLER, Verh. k. k. zool.-bot. Gesell. Wien, XXIII, 1873, p. 273.—WALSINGHAM, Trans. Am. Ent. Soc., X, 1882, p. 181.

¹ Proc. Ent. Soc. Phila., III, p. 508.

Gelechia pudibundella CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 146.—RILEY, Smith's List Lep. Bor. Am., No. 5454, 1891.

Gelechia intermediella CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, pp. 89, 144.—WALSINGHAM, Trans. Am. Ent. Soc., X., 1882, p. 180.—MURTFELDT, Bull. U. S. Dept. Agri. Div. Ent., 23, 1871, p. 53.—RILEY, Smith's List Lep. Bor. Am., No. 5392, 1891.

Aristotelia pudibundella WALSINGHAM, Proc. Zool. Soc. Lond., 1897, p. 66.—BUSCK, Proc. U. S. Nat. Mus., XXIII, 1900, p. 226; Dyar's List Amer. Lep., No. 5576, 1903.

Aristotelia intermediella DIETZ, Smith's List Ins., N. Jersey, 1900, p. 475.

Of this species I have examined Zeller's types in Cambridge and in the U. S. National Museum, which are alike; also a large series of moths bred from apple by Miss Murtfeldt (as *intermediella*?) and at the U. S. Department of Agriculture.

Whether Miss Murtfeldt was right in her determination of her species bred from apple as *intermediella* Chambers, and consequently Lord Walsingham's conclusion that *intermediella* is synonymous with Zeller's species, is not apparent to me. A specimen in the National Museum determined by Lord Walsingham as *intermediella* does not strengthen the theory. I believe there are several more species than now recognized, all very similar, and that differences in the larvæ will show this, when sufficient breeding has been done. I have several closely similar specimens, bred and collected, which I feel confident are new species, but I shall not attempt further description until full life histories have been worked out, as it would only make this group still more intricate. At present at least it will be necessary and convenient to relegate Chambers's poorly defined species as a synonym, according to Lord Walsingham.

Pudibundella is as widely distributed and nearly as common as *roseosuffusella*. It is a somewhat smaller and darker species. Both species come freely to light.

Food plant.—Apple.

ARISTOTELIA MOLESTELLA Zeller.

Gelechia (Ergatis) molestella ZELLER, Verh. k. k. zool.-bot. Gesell. Wien, XXIII, 1873, p. 274.

Gelechia molestella RILEY, Smith's List Lep. Bor. Am., No. 5412, 1891.

Aristotelia molestella BUSCK, Dyar's List Amer. Lep., No. 5577, 1903.

The unique type of this species is in Lord Walsingham's collection and I have not examined it; but the species can without question be referred to the present genus from Zeller's description, and Mr. J. H. Durrant has kindly substantiated this for me in a letter after examining the type.

I have identified without hesitation a single female specimen in fine condition, collected in the District of Columbia (Busck), as this species, from Zeller's careful description, which tallies in every detail with my specimen.

ARISTOTELIA RUBIDELLA Clemens.

- Gelechia rubidella* CLEMENS, Proc. Acad. Nat. Sci. Phil., XII, 1860, pp. 163, 434; Proc. Ent. Soc. Phil., II, 1863, p. 121; Stainton Ed. Tin. N. Am., 1872, pp. 40, 115, 225.—CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 147.—RILEY, Smith's List Lep. Bor. Am., No. 5471, 1891.
- Gelechia rubensella* CHAMBERS, Can. Ent., IV, 1872, p. 193; Bull. U. S. Geol. Surv., IV, 1878, pp. 89, 147.—MURTFELDT, Can. Ent., VI, 1874, p. 222; Bull. U. S. Dept. Agr. Div. Ent., 23, 1891, p. 54.
- Gelechia pudibundella* CHAMBERS, Can. Ent., IX, 1877, p. 23.
- Gelechia (Ergatis) rubidella* WALSINGHAM, Trans. Am. Ent. Soc., X, 1882, p. 180.
- Eucatoptus rubidella* WALSINGHAM, Proc. Soc. Zool. Lond., 1897, p. 70.
- Aristotelia rubidella* DIETZ, Smith's List. Ins. N. Jersey, 1900, p. 475.—BUSCK, Dyar's List. Amer. Lep., No. 5578, 1903.

In the U. S. National Museum are two specimens determined by Lord Walsingham, one of which bears his blue label, No. 1188.

Habitat.—Eastern United States, West Indies. (Walsingham.)

ARISTOTELIA FUNGIVORELLA Clemens.

- Gelechia fungivorella* CLEMENS, Proc. Ent. Soc. Phila., III, 1864, p. 507; Stainton Ed. N. Am. Tin., 1872, p. 261.—WALSH, Proc. Ent. Soc. Phila., VI, 1866, p. 273.—PACKARD, Guide, 1870, p. 350.—CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, pp. 122, 143.—RILEY, Smith's List Lep. Bor. Am., No. 5367, 1891.
- ?*Gelechia salicifungiella* CLEMENS, Proc. Ent. Soc. Phila., III, 1864, p. 508; Stainton, Ed. N. Am. Tin., 1872, p. 262.—WALSH, Proc. Ent. Soc. Phila., VI, 1866, p. 273.—PACKARD, Guide, 1870, p. 350.—CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, pp. 122, 147.—RILEY, Smith's List Lep. Bor. Am., No. 5475, 1891.
- Aristotelia fungivorella* BUSCK, Dyar's List Amer. Lep., No. 5579, 1903.

Clemens' types in the Philadelphia Academy of Natural Sciences are lost. In the U. S. National Museum is a specimen labeled *fungivorella* by Riley and another, identical, named by Lord Walsingham.

From the mounting, the pin and the label of the Riley specimen I have a strong suspicion that it is really one of Clemens' type specimens, or at least one of the specimens originally bred by Walsh. They agree well with description. I have accidentally bred a series of what I believe is this species from willow, presumably from unnoticed cecidomid galls on the leaves in my cage. I have also beaten this same species from willow repeatedly in the vicinity of Washington.

It seems likely that *salicifungiella* bred at the same time also from willow galls, and which, according to Clemens, has the same character of markings, is only a variety of *fungivorella*, as Clemens himself suggested.

Careful and extensive breeding will here again enable definite conclusions to be drawn.

Habitat.—Illinois (Walsh); District of Columbia (Busck).

ARISTOTELIA IVÆ Busck.

Aristotelia ivæ BUSCK, Proc. U. S. Nat. Mus., XXII, 1900, p. 225, pl. i, fig. 1.—
DYAR, Proc. Ent. Soc. Wash., p. 470, 1901 —BUSCK, Dyar's List Amer. Lep.,
No. 5580, 1903.

This species is very near to what I take to be *fungivorella* Clemens, but the knowledge of the larva and its life mode at once show the distinctiveness of the species.

Habitat.—Palm Beach, Florida (Dyar).

Food plant.—*Iva frutescens*.

Type.—No. 4932, U.S.N.M.

ARISTOTELIA BIFASCIELLA, new species.

Aristotelia bifasciella BUSCK, Dyar's List Amer. Lep., No. 5581, 1903.

Antennæ dark fuscous, with narrow silvery annulations. Labial palpi whitish; second joint mottled with dark brown; terminal joint with two dark brown annulations. Face, head, and thorax light ochreous. Forewings dirty yellowish white, with two conspicuous dark brown fasciæ; the first oblique from basal third of costa to middle of dorsal edge; the other is broader and nearly perpendicular on costal edge at apical third; both are shaded with lighter yellowish brown toward the dorsal edge. Just before apex is a dark brown costal spot, continued in a very light yellowish area across the wing. Extreme base of costa blackish brown. Hindwings light fuscous, cilia yellowish. Abdomen ochreous; legs whitish, with dark brown shadings on the outside; tarsi blackish brown, with tip of each joint white.

Alar expanse.—14 to 16 mm.

Habitat.—Argus Mountains, Arizona.

Type.—No. 6349, U.S.N.M.

A large easily recognized species, unlike any described American *Aristotelia*, but reminding one somewhat in size and coloration of *Epithectis bicostornaculella* Chambers.

ARISTOTELIA ELEGANTELLA Chambers.

Gelechia elegantella CHAMBERS, Can. Ent., III, 1872, p. 239; IX, 1877, p. 23; Bull. U. S. Geol. Surv., IV, 1878, p. 143.—RILEY, Smith's List Lep. Bor. Am., No. 5358, 1891.

Gelechia superbella CHAMBERS, Can. Ent., VII, 1875, p. 32.

Aristotelia elegantella BUSCK, Dyar's List Amer. Lep., No. 5582, 1903.

I have examined the types of this charming species in Cambridge; it was described from Texas, and later recorded from Missouri by Chambers. In the U. S. National Museum are specimens from Arizona and New Mexico; the latter collected by Mr. T. D. A. Cockerell. One specimen is labeled *Pa.*, but probably by mistake, as it is likely confined to southern localities. I have never seen it in the vicinity of Washington.

ARISTOTELIA ARGENTIFERA, new species.

Aristotelia argentifera BUSCK, Dyar's List Amer. Lep., No. 5583, 1903.

Antennæ slightly serrate toward the tip, black, with silvery-white annulations. Labial palpi, second joint light brown, with two incomplete white annulations; terminal joint blackish brown, with extreme tip and three narrow annulations white. Face whitish, tinged with brown; head and thorax light brown, intermixed with slate-colored scales. Forewings clear, deep brown, overlaid on costal half with dark, blackish brown. From near base of costa is an outwardly directed oblique white fascia, reaching nearly to dorsal margin, and edged and continued by strongly metallic silvery and bluish iridescent scales. At middle of wing is a costal white dash, continued downward and slightly inward nearly to the dorsal edge by a fascia of metallic scales. At beginning of costal cilia is a similar larger white dash, continued obliquely inward and downward by a line of metallic scales. Between the first and the second fascia is an additional smaller white costal spot, edged by metallic scales, and at the extreme apex is an ill-defined small group of white scales. From the very base of the wing outward and downward is a thin line of iridescent and silvery white scales, and single iridescent scales are found irregularly and sparsely in the other part of the wing. Cilia whitish, mixed with brown. Hindwings light silvery fuscous; cilia, with a golden-brown tint.

Abdomen brown with each joint tipped with silvery white. Legs blackish brown with silvery white bars and annulations; spurs silvery white.

Alar expanse.—10.5 to 11.5 mm.

Habitat.—San Francisco County, California.

Type.—No. 6350, U.S.N.M.

Described from 10 well-preserved specimens collected in October, probably by Mr. Koebele, judging from the elegant mounting.

I found a single specimen of this species in the Museum of Comparative Zoology in Cambridge, labeled by Lord Walsingham "*Gelechia argentifera*," which appropriate name I am pleased to adopt.

ARISTOTELIA COCKERELLA, new species.

Aristotelia cockerella BUSCK, Dyars List Amer. Lep., No. 5584, 1903.

Antennæ dark brown with yellow annulations. Labial palpi yellow, second joint sparsely sprinkled with black. Face, head, and thorax light greenish yellow. Basal two-thirds of forewings light yellow, concolorous with thorax; apical third dark purplish brown with a slight touch of yellow on costal edge before apex. The limit between these two colors is oblique and sharply drawn, forming a straight line from the beginning of costal cilia obliquely inward to apical two-fifths

of dorsal edge, the yellow reaching farther outward at costa and the brown reaching farther inward at dorsal edge.

On the dividing line between the two colors is an oblique row of three circular metallic golden spots edged with deep black. Cilia dark brown. Hindwings shining bluish black; cilia brown.

Abdomen deep brown above; on the underside is each joint edged by a silvery white transverse line; anal tuft yellow. Legs greenish yellow; tarsi black with white annulations.

Alar expanse.—11.5 to 12.5 mm.

Habitat.—Mesilla Park, New Mexico. (Cockerell.)

Type.—No. 6351, U.S.N.M.

Named in honor of the collector, who has sent me this exquisite species among several other Tineina. It is somewhat on the order of *Aristotelia elegantella* Chambers and fully as handsome.

ARISTOTELIA ABSCONDITELLA Walker.

Gelechia absconditella WALKER, Cat. Lep. Het. Br. Mus., XXIX, 1864, p. 595.—

RILEY, Smith's List Lep. Bor. Am., No. 5298, 1891.

Gelechia [*Anacamptis*] *absconditella* WALSHINGHAM, Trans. Am. Ent. Soc. Phila., X, 1882, p. 181.

Anacamptis absconditella DIETZ, Smith's List Ins. N. Jersey, 1900, p. 475.

Gelechia palpiannulella CHAMBERS, Can. Ent., IV, 1872, p. 68; Bull. U. S. Geol. Surv., IV, 1878, p. 145.

Aristotelia absconditella BUSCK, Dyar's List Amer. Lep., No. 5585, 1903.

Chambers's types of this species in Cambridge are identical with a large bred series in U. S. National Museum, determined by Lord Walsingham. The larvæ live in the stems of *Polygonum acre*, causing a slight swelling at the joints, and are found very commonly in the vicinity of Washington. Frequently every joint of a plant contains a larva. The species overwinters in the stems as larvæ, and the moths issue during May and June. It is of interest to note that the peculiar shining color of this species is identical with that of another polygonum feeding Tineid, *Gelechia disconceliella* Chambers.

The superficial resemblance to the *tæniionella* group of Europe has induced Lord Walsingham, and subsequently Dr. Dietz, to place this species in *Aproærema* Durrant (*Anacamptis* auct.), but the venation shows that it belongs to the present genus.

This species has been bred in the insectary of U. S. Department of Agriculture under the number 3373.

Under No. 4575 has been reared another large series of *Aristotelia* from the roots of *Ampelopsis quinquefolia*, received from Mr. G. Barlow, Cadet, Missouri, and issued in March and April, 1890.

These moths average a trifle larger than those bred from *Polygonum*, but I can not otherwise distinguish them, and am forced, at present at least, to place them under this species in spite of the improbability that one species should have both food plants. Possibly some mistake

may have taken place in the record. Even the minute characteristics of the antennæ and palpi, pointed out by Lord Walsingham in *absconditella*, are found identically in the specimens bred from *Ampelopsis*.

I have seen specimens of this species from New Jersey, Pennsylvania, Maryland, District of Columbia, Virginia, West Virginia, and Missouri.

ARISTOTELIA MINIMELLA Chambers.

Gelechia minimella CHAMBERS, Can. Ent., VI, 1874, p. 243; Bull. U. S. Geol. Surv., IV, 1878, p. 145.—RILEY, Smith's List Lep. Bor. Am., No. 5411, 1891.
Aristotelia minimella BUSCK, Dyar's List Amer. Lep., No. 5586, 1903.

Type no. 455 in the U. S. National Museum, labeled by Chambers and received from him as type of *Gelechia minimella*, is, together with two similar types in Cambridge, the only authentic material left by Chambers of this species.

All three are in bad condition, but I have saved for posterity the loose wings of one side of the type in the National Museum on a slide, which, under the microscope, shows that the specimen is a true *Aristotelia*.

I believe that the Cambridge specimens are identical, but their condition does not permit certainty. However, under the circumstances I feel justified to hold the National Museum specimen as the type, thus enabling us to put down the species as a known quantity instead of as an uncertain, name belonging to a valueless description.

I have received specimens of this *Aristotelia* reared from oak by Miss Mary Murtfeldt at Kirkwood, Missouri.

The types are from Texas. In the National Museum are specimens from New Jersey (Kearfott) and District of Columbia (Busck).

ARISTOTELIA PHYSALIELLA Chambers.

Gelechia physaliella CHAMBERS, Can. Ent., IV, 1872, p. 173; Cinn. Quart. Jour. Sc., II, 1875, p. 238; Bull. U. S. Geol. Surv., III, 1877, p. 128; IV, 1878, pp. 117, 145.—RILEY, Smith's List Lep. Bor. Am., No. 5446, 1891.
Aristotelia physaliella BUSCK, Dyar's List Amer. Lep., No. 5587, 1903.

Type No. 457 in the U. S. National Museum, received from Chambers and labeled in his handwriting, undoubtedly represent this species. I have met with no other specimens in other collections.

Habitat.—Kentucky, Arizona. (Chambers.)

Food plant.—*Physalis viscosa*. (Chambers.)

ARISTOTELIA DISCONOTELLA Chambers.

Gelechia disconotella CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, pp. 86, 143.—RILEY, Smith's List Lep. Bor. Am., No. 5354, 1891.
Aristotelia disconotella BUSCK, Dyar's List Amer. Lep., No. 5588, 1903.

The type of this species with Chambers' handwriting on the label

is in the Museum of Comparative Zoology. It is in fairly good condition and agrees well with his description.

In the National Museum is a perfect specimen, bred by Mr. F. C. Pratt from stem of raspberry, June 2, 1898.

Habitat.—Kentucky (Chambers). District of Columbia (Pratt).

ARISTOTELIA GILVOLINIELLA Clemens.

Gelechia gilvoliniella CLEMENS, Proc. Ent. Soc. Phila., II, 1863, p. 119; Stanton Ed. N. Am. Tin., 1872, pp. 223, 224 —CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 143.—RILEY, Smith's Hist. Lep. Bor. Am., No. 5380, 1891.
Aristotelia gilvoliniella BUSCK, Dyar's List Amer. Lep., No. 5589, 1903

The type of this species is lost, but from Dr. William Dietz I have received a specimen, which he has determined as *gilvoliniella*, and which I have no doubt really represents this species. It agrees well with description and is a typical *Aristotelia*.

The specimen in National Museum, as well as others in Dr. Dietz's collection, were collected in Pennsylvania, where presumably Clemens also found his type.

ARISTOTELIA KEARFOTTELLA, new species.

Aristotelia kearfottella BUSCK, Dyar's List Amer. Lep., No. 5590, 1903.

Antennæ fuscous, silvery white at base. Labial palpi silvery white; second joint with a black bar on the outside; terminal joint longer than second joint, with tip black. Face, head, and thorax silvery white. Forewings at base silvery white, gradually becoming overlaid with fuscous outward; outer half of wing dark fuscous with a silvery yellowish luster. At the end of the cell is a small round black dot. At beginning of costal cilia is a short oblique triangular light yellow spot. At base of cilia, round the entire apical edge, is a heavy deep black line, interrupted by four costal and three dorsal short indistinct yellowish-white dashes, which are faintly continued out in the dark fuscous cilia. Dorsal edge opposite the costal triangular spot yellowish. The underside of the forewings is uniformly dark, shining fuscous, with the costal spot and the apical streaks of yellow faintly indicated.

Hindwings dark fuscous, nearly black, with silvery reflexions; cilia dark steel-gray; abdomen dark gray; legs silvery white; tuft on hind tibiae yellowish; tarsi shaded with fuscous.

Alar expanse.—12 mm.

Habitat.—Pennsylvania, New Jersey.

Type.—No. 6352, U.S.N.M.

Cotypes are in the collection of Mr. William D. Kearfott, in honor of whom I name this species and from whom the National Museum has obtained its specimens.

ARISTOTELIA QUINQUEPUNCTELLA, new species.

Aristotelia quinquepunctella Busck, Dyar's List Amer. Lep., No. 5591, 1903.

Antennæ light yellowish brown, annulated with white. Labial palpi, second joint fuscous with white apex; terminal joint yellow with fuscous shading toward the tip. Face yellowish white. Head and thorax yellow. Forewings pale whitish yellow, sparsely sprinkled with fuscous on disk, more strongly overlaid with fuscous along the edges and gradually more so toward the tip, which is quite dark. On the disk are four nearly equidistant black prominent dots forming a rhomb; one within the costal edge at basal third, one opposite a little farther outward, within dorsal margin on the fold, a third also on the fold near base, and the fourth on the middle of the wing. A fifth similar black spot is found just outside the end of the cell at the same distance from point four as that between the other dots. Cilia yellow with an indistinct dark line at base parallel with the edge of the wing. Hindwings light silvery fuscous. Cilia dark yellowish fuscous. Abdomen dark fuscous. Legs yellowish, shaded with fuscous; anterior coxæ in front dark fuscous.

Alar expanse.—11.5 mm.

Habitat.—Pennsylvania (June).

Type.—No. 6353, U.S.N.M.

The moth has a certain general resemblance with *Trichotaphe trimaculella* Chambers. I have tried to reconcile this species with the description of the unrecognized *Gelechia punctiferella* Clemens, which seems to be a similar species, but without success.

HELICE Chambers.

Plate XXIX, fig. 12.

Helice CHAMBERS, Can. Ent., V, 1873, p. 187.

Labial palpi very long, smooth, curved; second joint somewhat thickened toward apex with appressed scales; terminal joint longer than second, slender, pointed.

Forewings narrow, elongate ovate, pointed; 11 veins, 5 absent, 7 and 8 out of 6, 3 and 4 stalked. Hindwings narrower than forewings, apex produced pointed, termen emarginate, anal angle rounded; 6 veins, 5 and 6 absent, 3 and 4 stalked, transverse vein obsolete. Forewing with tufts of raised scales.

Only the one species is known.

HELICE PALLIDOCHELLEA Chambers.

Helice pallidochrella CHAMBERS, Can. Ent., V, 1873, pp. 188, 230; VII, 1875, p. 105; IX, 1877, p. 231; Bull. U. S. Geol. Surv., IV, 1878, p. 150.—Busck, Journ. N. Y. Ent. Soc., X, 1902, p. 89; Dyar's List Amer. Lep., No. 5592, 1903.

Helice pallidochrella CHAMBERS, Can. Ent., IX, 1877, p. 15.

Helice gleditschuella CHAMBERS, Can. Ent., IX, 1877, p. 232.

Gelechia gleditschiella CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 144.—RILEY, Smith's List Lep. Bor. Am., 1891, p. 113.

Not *Helice pallidochrella* WALSINGHAM, Trans. Am. Ent. Soc. Phila., X, 1882, p. 188.—MURTFELDT, Can. Ent., XV, 1883, p. 95.

I have given a full review of this species, types of which are in the Museum of Comparative Zoology and in U. S. National Museum.

Habitat.—Kentucky.

EVIPPE Chambers.

(Plate XXIX, fig. 13.)

Evippe CHAMBERS, Can. Ent., V, 1873, p. 185.

Phætusa CHAMBERS, Can. Ent., VII, 1875, p. 106.

Labial palpi long recurved, nearly smooth, second joint somewhat thickened beneath, terminal joint slender, pointed, nearly as long as second joint. Forewings elongate ovate, pointed, 12 veins, 7 and 8 out of 6, 4 and 5 connate, or short stalked, rest separate.

Hindwings nearly as broad as forewings, trapezoidal, apex produced, pointed, termen sinuate; 7 veins, 6 absent, 7 to costa just before apex, 3 and 4 connate, 5 approximate to 4, 2 distant. Cell not closed between 5 and 7.

Chambers's types of the types of both genera are in the U. S. National Museum and prove that they are congeneric. Chambers compared generically and specifically his *Phætusa plutella* with *Evippe prunifoliella* saying:

The only reason for separation is found in the neuration. The other characters are those of *Evippe*, and it (*plutella*) is very near to *prunifoliella* in ornamentation.¹

But he contradicts himself in trying to show the supposed differences in venation by writing that

The last branch of median vein in forewing of *Evippe* is simple, while in the original description of that genus he says:

Median becomes furcate behind the cell.

And this he repeats while describing his genus *Eidothoa*.²

The latter statement is correct, and thus it is also in *Phætusa*, as stated by Chambers.

The only other differences in venation pointed out by Chambers are in the hindwings, where he thought that vein 6 and discal nervure is present in *Phætusa* while absent in *Evippe*. It is easy to see, with a perfect side of the wing before one, how the fold has misled Chambers to see a vein 6, which really is not present, and a similar mistake

¹ Can. Ent., VII, p. 106.

² Idem., V, p. 187.

about the discal vein is quite natural, considering how rather crude his way of denuding such very small and delicate wings was.¹

Thus the name *Phaetusa*, which was preoccupied anyway, must be dropped as synonymous with *Evippe*.

Lord Walsingham suggested² that the two species even were identical, but Chambers³ wrote that he could not agree to that view, and the two types in U. S. National Museum, as well as his types in Cambridge, support Chambers. They surely represent two good species, which may be separated thus:

With white costal spot..... *prunifoliella*
Without white costal spot..... *leuconota*

EVIPPE PRUNIFOLIELLA Chambers.

Evippe prunifoliella CHAMBERS, Can. Ent., V, 1873, p. 186; VII, 1875, p. 105; IX, 1877, p. 23; Bull. U. S. Geol. Surv., IV, 1878, pp. 112, 141.—BUSECK, Dyar's List Amer. Lep., No. 5593, 1903.

Gelechia prunifoliella CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 146.—WALSINGHAM, Trans. Am. Ent. Soc. Phila., X, 1882, p. 177.—MURTFELDT (Chambers quoted), Can. Ent., XV, 1883, p. 94. RILEY, Smith's List Lep. Bor. Am., No. 5452, 1891.

An authentic specimen received from Chambers and with his label on the pin is in U. S. National Museum. Also several other specimens, bred from *Prunus* by Miss Murtfeldt, from peach by Mr. Chambliss and from both by the writer.

Habitat.—Kentucky (Chambers), Missouri (Murtfeldt), Tennessee (Chambliss), District of Columbia (Buseck).

EVIPPE LEUCONOTA Zeller.

Gelechia [*Teleia*] *leuconota* ZELLER, Verh. k. k. zool.-bot. Gesell. Wien, XXIII, 1873, p. 268, pl. III, fig. 21.

Gelechia leuconota CHAMBERS, Bull. Geol. Surv., IV, 1878, p. 144.—RILEY, Smith's List Lep. Bor. Am., No. 5401, 1891.

Phaetusa plutella CHAMBERS, Can. Ent., VII, 1875, p. 106; Bull. U. S. Geol. Surv., IV, 1878, p. 160.—WALSINGHAM, Trans. Am. Ent. Soc. Phila., X, 1882, p. 177.—MURTFELDT, Can. Ent., XV, 1883, p. 94.—RILEY, Smith's List Lep. Bor. Am., No. 1512, 1891.

Evippe leuconota BUSECK, Dyar's List Amer. Lep., No. 5594, 1903.

Chambers himself suggested the above synonymy, and his type of *Phaetusa plutella* in the U. S. National Museum (No. 466) proved on comparison with Zeller's type of *Gelechia leuconota* in the Museum of Comparative Zoology to be identical.

Habitat.—Texas.

¹ Can. Ent., IV, p. 41.

² Trans. Am. Ent. Soc. Phila., X, 1882, p. 177.

³ Through Miss Murtfeldt, Can. Ent., XV, p. 94-95.

EUCORDYLEA Dietz.

Plate XXIX, fig. 14.

Eucordylea DIETZ, Ent. News, XI, 1900, p. 349.

Labial palpi large, robust, second joint with dense expansible tuft of long hairs on the upper side, terminal joint shorter than second, smooth, pointed.

Forewings elongate, narrow, dorsal edge slightly sinuate at vein 2, apex obtusely pointed; 12 veins, 7 and 8 out of 6; 3, 4, and 5 long, approximate from lower corner of cell; 2 distant, short. Hindwings trapezoidal, apex blunt, termen slightly bisinuate; 8 veins, 3 and 4 nearly connate, 5 approximate to 4, 6 and 7 connate.

This genus is a specialized development from *Recurvaria* Haworth, easily recognized by the peculiar palpi.

Only the one species is described; in Dr. Dietz's collection is another, smaller, mottled-gray species, which he kindly offered the writer for description, but it is not, in my judgment, in sufficiently good condition to describe.

I am under obligation to Dr. Dietz for his liberal permission to make a slide of his unique type specimen in order to determine the venation with certainty. The figure is made from this type slide.

EUCORDYLEA ATRUPECTELLA Dietz.

Eucordylea atrupectella DIETZ, Ent. News, XI, 1900, p. 350, pl. 1, figs. 1 and 1a.—
BUSCK, Dyar's List Amer. Lep., No. 5595, 1903.

I have had opportunity to study carefully the type of this species in Dr. Dietz's collection; it is a male. In the U. S. National Museum is another perfect male specimen, received from A. W. Hanham, collected in Ontario, Canada; the type is from Pennsylvania.

RECURVARIA Haworth.

Plate XXIX, fig. 15.

Recurvaria HAWORTH, Lep. Brit. Lond., 1829, p. 547.*Eragora* CLEMENS, Proc. Acad. Nat. Sc. Phila., 1860, p. 165.*Eidothoa* CHAMBERS, Can. Ent., V, 1873, p. 186.*Sinoë* CHAMBERS, Can. Ent., V, 1873, p. 231.*Aphanutula* MEYRICK, Handbook Br. Lep., 1895, p. 579.Not *Recurvaria* (Haworth) MEYRICK, Handbook Br. Lep., 1895, p. 606.

Labial palpi slightly thickened, with rough scales beneath; terminal joint pointed, shorter than second joint. Forewings elongate, narrow, pointed, dorsal edge slightly sinuate at vein 2; 12 veins, 7 and 8 out of 6; 3, 4, 5 long, approximate from end of cell, 2 short, separate. Hindwings narrower than forewings, trapezoidal, apex produced, pointed, termen sinuate; 8 veins, 3 and 4 connate, 5 approximate to 4, 6 and 7 approximate. Forewings often with raised scales. The males of several of the American species have the costal hair pencil at base of

hindwing, which Zeller mentions in his species, belonging to this genus and which Lord Walsingham regarded as of generic value.¹

I have before (p. 771) given the reasons why I can not agree with him in this.

Clemens's careful definition of *Eragora apicitripunctella* does not leave any doubt about the generic characters of that species, even if there may be some differences of opinion about the identification of the species (p. 809).

The type of Chambers's genus *Sinoë* is *fuscopallidella*, of which the unique type is in the Museum of Comparative Zoology. This is in very poor condition, but shows positively that its generic characters are the same as those of *Eragora* and of the two European species, *nanella* Hübner and *leucitella* Linneus, at present included by Staudinger and Rebel in *Recurvaria* as now restricted (*Alphanaula* Meyrick).

The type of Chambers's genus *Eidothoa*, *vagationella*, I regard as synonymous with Zeller's *Gelechia dorsinitella*, which also belongs to the present genus.

The recognized species of *Recurvaria* in America may be separated by the following table:

Forewings more or less ochreous	1
Forewings not ochreous	4
1. Labial palpi pure white	<i>variella</i> , p. 809
Labial palpi with dark markings	2
2. Forewings with distinct row of black dots on costal apical edge	3
Forewings without such distinct dots	<i>obliquestrigella</i> , p. 811
3. Forewings with indistinct angulated whitish fascia	<i>apicitripunctella</i> , p. 808
Forewings without such fascia	<i>colobrina</i> , p. 810
4. Forewings very dark, nearly unicolorous	<i>nigra</i> , p. 814
Forewings lighter, not unicolorous	5
5. Forewings with oblique pronounced costal white streak at basal third	<i>cristatella</i> , p. 814
Forewings without such pronounced streak	6
6. Forewings with black dorsal patch near base	<i>robinella</i> , p. 812
Forewings without such patch	7
7. Dorsal edge of wings pure white	<i>dorsinitella</i> , p. 813
Dorsal edge not white	8
8. Males with costal hair pencil at base of hindwing	<i>guercivorella</i> , p. 813
Males without such hair pencil	<i>cratagella</i> , p. 811

RECURVARIA APICITRIPUNCTELLA Clemens.

- Eragora apicitripunctella* CLEMENS, Proc. Acad. Nat. Hist. Phila., 1860, p. 165; Stainton Ed. No. Am. Tin., 1872, p. 120.—CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 141.—RILEY, Smith's List Lep. Bor. Am., No. 5297, 1891.
- Gelechia (Eragora) apicitripunctella* WALSHINGHAM, Trans. Am. Ent. Soc. Phila., X, 1882, p. 182.
- Gelechia abietella* PACKARD, U. S. Dept. Agr. Rep., 1883, p. 150, pl. III, fig. 2; pl. XIII, fig. 7; Rep. U. S. Ent. Comm., 1890, p. 878, pl. IX, fig. 2; pl. XXVI, fig. 7.
- Recurvaria apicitripunctella* BUSCK, Dyar's List Amer. Lep., No. 5596, 1903.

¹Proc. Zool. Soc. Lond., 1897, p. 64.

While there is no difficulty about the identity of Clemens's genus, it is not quite so satisfactory with the specific identity of his type of the genus.

Lord Walsingham placed it as synonymous with Zeller's *gilvoscopella*, and as Clemens' type is not in existence it is difficult to prove or disprove the identity absolutely, and I should have left it on Walsingham's authority, even though the synonymy seemed very strange from the quite different descriptions of the two species, if I had not been able to examine the evidence on which Lord Walsingham based his opinion in 1882.

These specimens (labeled with Lord Walsingham's blue labels, nos. 148, 149, and 150, corresponding to his identification in his notebook¹), are in Professor Fernald's collection, and they surely are not the same as the type of Zeller's *gilvoscopella*, preserved in excellent condition in the Museum of Comparative Zoology.

They are in rather poor condition, but agree as far as can be made out with undoubted specimen of *abietisella* Packard, a large, bred series of which is in the U. S. National Museum.

Here also are to be found two specimens labeled in Lord Walsingham's handwriting *apicitripunctella*, one determined in 1887 and one in 1891. The first is bred from locust and is *robinella* Fitch (p. 812), and the other is the same as the specimens in Professor Fernald's collection and is *abietisella* Packard.

That Lord Walsingham at that time, with the limited material at his command, was not very certain about these nearly related, similar species is shown by his suggestion² that *dorsivittella* Zeller and *cristatella* Chambers might also be mere varieties of *apicitripunctella*.

Clemens's description agrees well with *abietisella*, but can not be reconciled with Zeller's description of *gilvoscopella*, the one belonging to the ochreous group, the other to the fuscous.

While, then, absolute proof about this species can not be obtained because the type is lost, it seems evident to me, after careful analysis of the different descriptions and with large series of mostly bred specimens of all these allied species before me, that *apicitripunctella* (1) can not be Zeller's *gilvoscopella*, and (2) can not be any other species than Packard's *abietisella*.

Food plant.—*Abies canadensis*.

The males have the hair pencil at base of the hindwings.

RECURVARIA VARIELLA Chambers.

Gelechia variella CHAMBERS, Can. Ent., IV, 1872, p. 174; VI, 1874, p. 241; Bull. U. S. Geol. Surv., IV, 1878, p. 148.—RILEY, Smith's List Lep. Bor. Am., No. 5507, 1891.

Recurvaria variella BUSCK, Dyar's List Amer. Lep., No. 5597, 1902.

¹See preface, p. 768.

²Trans. Am. Ent. Soc. Phila., X, p. 182.

Type No. 465 in the U. S. National Museum of this species, received from Chambers with his handwriting on the label, is identical with types in the Museum of Comparative Zoology in Cambridge.

They are in very poor condition, but agree well with description, and unquestionably represent this species. A slide of the wings made from the one side of the National Museum type, for the double purpose of preserving and studying the species, shows that it belongs in the present genus.

I have bred a large series of these moth from bald cypress (*Taxodium distinctum*) on grounds of the U. S. Department of Agriculture, Washington, District of Columbia. The larvæ work in the same way as *apictripunctella* on hemlock, uniting a few needles and feeding between them. The pupa is also found in silk lined tubes formed of a few needles. Several generations occur during the summer, the imagoes of one of which are very abundant in early July.

RECURVARIA COLUBRINÆ, new species.

Recurvaria colubrinæ BUSCK, Dyar's List Amer. Lep., No. 5598, 1902.

Antennæ light brown with white annulations. Labial palpi with second joint light brown, white at apex; terminal joint white with a broad brown annulation round middle and a narrow one just before the tip.

Face, head, and thorax reddish white with scattered light-brown scales. Forewings dirty ochreous white, outer half suffused with light fuscous. On costa are three equidistant brown spots, one near base, one at middle, and one at the beginning of costal cilia. In the middle of the wing are three small brown spots in a straight longitudinal line, one at basal third, one at middle of wing, and one at the end of the cell. Just within the dorsal cilia are two large ill-defined longitudinal brown spots, and at apical edge is a row of dark dots.

Cilia whitish, mixed toward apex with fuscous. Hindwing silvery fuscous, cilia yellowish. Legs dark brown with white annulations; posterior tibial above yellowish white.

Alar expanse.—10 mm.

Type.—No. 6354, U.S.N.M.

This moth was bred in the insectary of U. S. Department of Agriculture by Mr. Th. Pergande, from *Psylla* galls on *Colubrina texensis* received from Mr. E. A. Schwarz, from Rockport, Texas, August, 1894.

Mr. Pergande writes in the notebook on this species under no. 6336:

Found in *Psylla* galls on *Colubrina texana*, a small Tineid larva of a yellowish white color with the incisions between the segments pinkish and the head and cervical shield yellow. This larva feeds upon the Psyllids; there were also found within the galls a few pupæ belonging to this larva.

Although unwilling to doubt so careful and trained an observer as Mr. Pergande, I would say that the generic relations of the species

indicate that the Psyllid-galls were merely used as an accidental convenient retreat for pupation and that the species probably is a vegetable feeder as the other species of the genus, whose life histories are known.

RECURVARIA OBLIQUISTRIGELLA Chambers.

Anarsia obliquistrigella CHAMBERS, Can. Ent., IV, 1872, p. 65.

Gelechia obliquistrigella CHAMBERS, Can. Ent., IV, 1872, p. 175; VII, 1875, p. 106; IX, 1877, p. 24; X, 1878, p. 50; Bull. U. S. Geol. Surv., IV, 1878, p. 145.—RILEY, Smith's List Lep. Bor. Am., No. 5422, 1891.

Recurvaria obliquistrigella BUSCK, Dyar's List Amer. Lep., No. 5599, 1902.

Not *Gelechia obliquistrigella* PACKARD, U. S. Ent. Comm. Rep., V, 1890, p. 850, fig. 284.

In Professor Fernald's collection I have examined several specimens received from Chambers as this species and identified by Lord Walsingham in 1882 as *obliquistrigella*. One of these I obtained through the kindness of Professor Fernald for the U. S. National Museum. They are identical with the type in the Museum of Comparative Zoology, as far as the miserable condition of this latter permits identification. At least they agree generically and belong to the present genus. These specimens agree tolerably well with Chambers's description.

Packard¹ figures a *Gelechia*, bred from spruce and which had been determined by Professor Fernald as *Gelechia obliquistrigella*.

But the species figured is surely not the present species, agreeing neither with the types nor with the description of *obliquistrigella*, the food plant of which must for the present stand unknown.

This species has not the hair pencil at base of hindwing in the males.

RECURVARIA CRATAEGELLA, new species.

Recurvaria crataegella BUSCK, Dyar's List Amer. Lep., No. 5600, 1902.

? *Recurvaria nanella* Hübner, Staudinger and Rebel Cat. Eur. Lep., II, No. 2874, 1901.

Antennæ whitish with indistinct narrow dark-brown annulations. Labial palpi whitish with two black annulations on each joint, tip white. Face, head, and thorax white suffused with fuscous.

Forewings white thickly sprinkled with fuscous. From near the base of costa is an outwardly directed oblique ill-defined black streak, not reaching to the dorsal edge, more or less interrupted at the fold and bordered on the outside with white scales. From middle of costa is a similar, parallel, interrupted dark streak still less clearly defined. At the end of the cell in middle of wing is a short black longitudinal streak; below this on dorsal edge is a small black spot and on costal edge is two similar black spots, one at apical third, the other just

¹U. S. Ent. Comm. Report, V, p. 850, fig. 284.

before apex. Cilia white, speckled black, and fuscous. Hindwings light silvery fuscous, cilia a shade lighter than wing; male without costal hairpencil.

Abdomen dark fuscous, anal tuft silvery gray; legs white with black annulations; hairs on posterior tibia silvery white. Alar expanse, 12 mm.

Type.—No. 6355, U.S.N.M.

Bred by Dr. William Dietz in Hazleton, Pennsylvania, from *Crataegus tomentosus* in June, but without any notes on the larva or its habit.

The species is very near the other fuscous species of the genus and easily mixed with *cristatella* Chambers, but besides minor colorational differences, it differs in the lack of hairpencil at base of hindwings in the male.

I am, at present, unable to separate this species from a series of authentic European specimens of *Recurvaria nanella* Hübner, and I am conscious of the probability of my making a synonym of this species, the life history of which, according to Meyrick's Handbook of British Lepidoptera, is not definitely known, but which is variously said to feed in flowers or in shoots of pear or on lichens growing on the trunk.

As long as definite knowledge of the larva of both species is lacking, I regard it a much better policy to treat the American form as a distinct species, instead of running the risk of wrongly recording European species in America, which has already been done, too hastily in my opinion, in other groups of *Tineinæ*. Such records are very difficult to disprove, and, if wrong, not only encumber our lists and tables, but give false ideas of geographical distribution.

RECURVARIA ROBINIELLA Fitch.

Anacampsis robinella FITCH, Rep. Nox. Benef. Insects N. York, V, 1859, p. 835.—CHAMBERS, Can. Ent., III, 1871, pp. 163, 183.

Gelechia robinella CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 146.—RILEY, Smith's List Lep. Bor. Am., No. 5469, 1891.

Sinoc fuscopallidella CHAMBERS, Can. Ent., V, 1873, p. 231; VII, 1875, pp. 105, 106.

Gelechia (Sinoc) fuscopallidella CHAMBERS, Can. Ent., IX, 1877, p. 24; Rep. U. S. Dept. Agr., 1879, p. 225.

Gelechia fuscopallidella CHAMBERS, Bull. U. S. Geol. Surv., 1878, IV, p. 143.—RILEY, Smith's List Lep. Bor. Am., No. 5371, 1891.

Gelechia robiniaefoliella CHAMBERS, Rep. U. S. Dept. Agr., p. 224, 1879.

Recurvaria robinella BUSCK, Dyar's List Am. Lep., No. 5601, 1902.

As already realized by Chambers, Fitch evidently made a mistake in associating his moth described as *Anacampsis robinella* with the larva and mine described under that name. This is clear, as he could not breed a moth with alar expanse 0.45 inch from a full-grown larva only 0.18 inch long.

Fitch collected his *Gelechia* leaves in the autumn and in the spring his moth appeared, so it seems reasonable that some other larger larva

have been present, unnoticed by Fitch, from which the moth came, which he associated with the larva and mine, he had taken notes on the previous fall. His description of the moth is not very satisfactory, but there is no other species feeding on Robinia but the present of about the size he gives, and it is reasonably certain that this is the species he had under consideration.

Chambers's type of *Sinus fuscopallidella* I have examined in the Museum of Comparative Zoology. It is in very poor condition, but agrees well with the description as far as could be made out, and shows positively that its generic characters are identical with those of *Evagora* Clemens, and also that it is specifically identical with the common Robinia-feeding species, which Chambers later described as *Gelechia robiniaefoliella*, he himself suggesting that it was the same species as previously described by him as *fuscopallidella*.

A large bred series is in U. S. National Museum.

The males have no hairpencil at base of hindwing.

Habitat.—Texas, Kentucky, eastern United States.

RECURVARIA QUERCIVORELLA Chambers.

Gelechia quercivorella CHAMBERS, Can. Ent., IV, 1872, p. 173; Bull. U. S. Geol. Surv., IV, 1878, p. 146 —RILEY, Smith's List Lep. Bor. Am., No. 5462, 1891.

Gelechia (Teleia) gilviscopella ZELLER, Verh. k. k. zool.-bot. Gesell. Wien, XXIII, 1873, p. 266.

Gelechia gilviscopella CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 144.—RILEY, Smith's List Lep. Bor. Am., No. 5297 (part) 1891.

Recurvaria quercivorella BUSCK, Dyar's List Amer. Lep., No. 5602, 1903.

Zeller's two types (males) of *gilviscopella* in the museum in Cambridge are in perfect condition and show this species to be a much larger and darker species than Clemens *apicirripunctella*. Identical specimens in large series are in U. S. National Museum. The type in Cambridge of Chambers *quercivorella* is in miserable condition, consisting only of head with palpi, thorax, and one forewing. It is, however, undoubtedly a *Recurvaria*, and I have no hesitancy, after careful comparison with Zeller's types of *gilviscopella*, to determine it as the same as this species, which is also an Oak-feeder.

Chambers' name must take precedence.

Habitat.—Kentucky, Texas, eastern United States.

RECURVARIA DORSIVITTELLA Zeller.

Gelechia (Telicia?) dorsivittella ZELLER, Verh. k. k. zool.-bot. Gesell. Wien, XXIII, 1873, p. 267, pl. III, fig. 20.

Gelechia dorsivittella CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 143.—RILEY, Smith's List Lep. Bor. Am., No. 5357, 1891.

Aristotelia dorsivittella WALSHINGHAM, Proc. Zool. Soc. Lond., 1897, p. 66.

Aristotelia dorsivittella DIETZ, Smith's List Ins. N. Jersey, 1900, p. 475.

Eidothoa vagaticella CHAMBERS, Can. Ent., V, 1873, p. 187; VII, 1875, p. 105.

Gelechia vagatioella CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 147.—RILEY, Smith's List Lep. Bor. Am., No. 5505, 1891.

Recurvaria dorsivittella BUSCK, Dyar's List Amer. Lep., No. 5603, 1903.

Type of *dorsivittella* was found in the museum in Cambridge in good condition in May, 1900, and agrees with a specimen determined by Lord Walsingham in the U. S. National Museum.

I assume the synonymy of Chambers' *vagatioella*, which seems reasonably certain from the generic and specific descriptions of that species, all authentic material of which is lost.

Habitat.—Texas, Kentucky, Eastern United States, West Indies.

RECURVARIA CRISTATELLA Chambers.

Gelechia cristatella CHAMBERS, Conn. Quart. Journ. Sc., II, 1875, p. 241; Bull. U. S. Geol. Surv., IV, 1878, p. 142.—RILEY, Smith's List Lep. Bor. Am., No. 5346, 1891.

Gelechia (Eragora) cristatella WALSHINGHAM, Trans. Am. Ent. Soc. Phila., X, 1882, pp. 179, 182.

Recurvaria cristatella BUSCK, Dyar's List Amer. Lep., No. 5604, 1903.

Type No. 449 in the U. S. National Museum, received from Chambers, is identical with four types examined by the writer in the Museum of Comparative Zoology.

The former is a male and has the yellow hair pencil on hindwing; so have the males in Cambridge. No other specimens are known to me.

Habitat.—Kentucky.

RECURVARIA NIGRA, new species.

Recurvaria nigra BUSCK, Dyar's List Amer. Lep., No. 5605, 1903.

Antennæ black, with indistinct narrow silvery annulations. Labial palpi with second joint black except at apex, which is silvery white; terminal joint white, with two broad black annulations; extreme tip white.

Face, head, and thorax black, with purplish reflections. Ground color of forewings silvery white, but so thickly overlaid with black and dark fuscous scales as to appear black to the naked eye. Under a lens is indistinctly seen six deep black spots of raised scales in two rows, one above, the other below fold. At apical fourth is a very narrow, irregular, V-shaped, silvery white fascia, with the angle pointed toward the tip of the wing, and farther out toward apex is a very indistinct thin row of white scales, parallel with the costal edge and meeting a similar line parallel to the dorsal edge just before apex. Cilia dark gray. Hindwings nearly black, with metallic luster. Legs black, with white annulations; tuft on posterior tibiæ silvery white.

Alar expanse.—11 mm.

Habitat.—District of Columbia.

Type.—No. 6356, U.S.N.M.

The larva feeds presumably on *Hypericum fruticosum*, but was not observed. The moth was reared accidentally May 5, in a jar containing another Tineid under observation on the above plant.

TRYPANISMA Clemens.

Plate XXIX, fig. 16.

Trypanisma CLEMENS, Proc. Ent. Soc. Phila., 1860, p. 168; N. A. Tineina, 1872, p. 125.

With his usual care Dr. Clemens characterized this genus, so that it can be readily and unquestionably recognized even with the type lost.

It has the labial palpi moderate, second joint slightly thickened, with rough scales beneath, terminal joint as long as second, rather thick, but smooth and pointed. Forewings elongate, pointed; 12 veins, 7 and 8 out of 6, 3 and 4 stalked; hindwings a little narrower than forewings, apex produced, termen emarginate; 8 veins, 3 and 4 connate, 5 approximate to 4, 6, and 7 stalked.

It was interesting to discover a new species of this genus with identical habits and structure.

The two known species can be thus separated:

Head and face white *fagella*, p. 816
Head and face suffused with fuscous *prudens*, p. 815

TRYPANISMA PRUDENS Clemens.

Trypanisma prudens CLEMENS, Proc. Ent. Soc. Phila., 1860, p. 168; Stainton Ed. Tin. N. Am., 1872, p. 125.—CHAMBERS, Can. Ent., V, 1873, p. 188.—RILEY, Smith's List Lep. Bor. Am., No. 5589, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5606, 1903.

Trypanisma prudens CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 166.

Gelechia quinqueannulella CHAMBERS, Can. Ent., IV, 1872, p. 191; Bull. U. S. Geol. Surv., IV, 1878, p. 146.—RILEY, Smith's List Lep. Bor. Am., No. 5464, 1891.

Clemens's type is lost, but I had no difficulty in positively identifying his species by rearing the characteristic larva, which feeds on the upperside of oak leaves under a thin sheet of silk, with a safety exit to the underside of the leaf, as Clemens described.

These bred moths, now in U. S. National Museum, agree perfectly, generically and specifically with Clemens' description, and represent without doubt the species.

They were carefully compared with and found identical with Chambers' type of *Gelechia quinqueannulella* in the Museum of Comparative Zoology in Cambridge, which, furnished with Chambers' label, was found sufficiently well preserved to be easily recognizable, and which agreed with his description.

Chambers' notes on the early stages further verifies this synonymy. Chambers wrote that he was not acquainted with *Trypanisma prudens*.¹

Habitat.—Pennsylvania, District of Columbia.

¹ Can. Ent., V, p. 188.

TRYPANISMA FAGELLA, new species.

Trypanisma fagella BUSCK, Dyar's List Amer. Lep., No. 5607, 1902.

Antennæ dark, fuscous, annulated with white. Labial palpi whitish, with a black annulation at base of terminal joint and one just before the tip. Face and head white, thorax light gray.

Ground color of forewings yellowish white, but thickly suffused with black and gray scales, so that the wings look light gray to the naked eye. At the middle of the cell is a circular group of dense black scales, followed by a patch of yellow, with only slight dark sprinkling. At beginning of costal cilia is a nearly black large outwardly directed streak, and on the dorsal side opposite a small corresponding black patch. These black markings are edged broadly on the outside with unsprinkled yellow.

Hindwing and cilia light silvery gray. Abdomen silvery gray. Legs on the outside barred with black and silvery yellow, on the inside silvery gray.

Alar expanse.—4 mm.

Habitat.—District of Columbia.

Type.—No. 6357, U.S.N.M.

The larva is similar to and feeds in the same manner as *T. prudens*, but has as food plant beech. Like the oak feeder, it pupates in a slight web on the underside of the leaf, which is drawn into a shallow fold.

The moth is generically identical with the type of the genus and resembles it in size and general appearance, but it is a much lighter species.

EPITHECTIS Meyrick.

Plate XXX, fig. 17.

Epitheatia MEYRICK, Handbook Brit. Lepidoptera, 1895, p. 580.

Taygete CHAMBERS (not *Taygetis* Hübner), Can. Entomologist, V, 1873, p. 231.

Parasia CLEMENS (not Duponchel), Proc. Acad. Nat. Sci. Phil., 1860, p. 173.

Meyrick's definition of this genus is as follows:

Second joint of labial palpi thickened with rough scales beneath, terminal nearly as long as second, somewhat roughened anteriorly. Forewings elongate, pointed, 7 and 8 out of 6. Hindwings I, trapezoidal, apex pointed, termen somewhat sinuate, cilia I; 3 and 4 connate, 5 somewhat approximate, 6 and 7 stalked.

A series of *attributella* Walker (*difficilisella* Chambers), type of Chambers' genus *Taygete* was submitted to Dr. Meyrick, who unhesitatingly pronounced his genus *Epitheatia* a synonym of Chambers' genus.

As, however, the name *Taygete* is preoccupied, Meyrick's later name will stand, and the genus must be included in the American fauna.

I have not personally examined any European species of the genus,

but that is superfluous after such an authoritative determination. Some of the American species have a tendency for veins 3 and 4 in hindwing to become short-stalked instead of connate and have the discal vein nearly obsolete. Some of the species present a character, which is noteworthy and which I do not know whether it is found in the European forms—at least, it is not noted by Mr. Meyrick in his generic synopsis—namely, the long-stalked veins 6 and 7 in the hindwing, which both go to the costal edge, not, as might be expected, inclosing the apex.

I am acquainted with the following species, which may be separated thus :

Forewings with black dash at tornus	<i>subsumella</i> , p. 819
Forewings without such dash	1
1. Entire wing overlaid with dark scales	2
Wing light with dark spots	3
2. Forewings with transverse markings	<i>galligenitella</i> , p. 819
Forewings without such	<i>syloiculella</i> , p. 818
3. Ground color whitish gray	<i>attributella</i> , p. 817
Ground color yellowish	4
4. Apical part of forewings light	<i>bicostomaculella</i> , p. 817
Apical part of forewings dark	<i>saundersella</i> , p. 819

EPITHECTIS ATTRIBUTELLA Walker.

Gelechia attributella WALKER, Cat. Lep. Brit. Mus., XXIX, 1864, p. 593.—WALSINGHAM, Trans. Amer. Ent. Soc., Phila., X, 1882, p. 182.—RILEY, Smith's List Lep. Bor. Am., No. 5315, 1891.

Eragura difficilisella CHAMBERS, Can. Ent., IV, 1872, p. 65.

Gelechia difficilisella CHAMBERS, Can. Ent., IV, 1872, p. 192; V, 1873, pp. 187-188; Bull. U. S. Geol. Surv., IV, 1878, p. 142.

Taygete difficilisella CHAMBERS, Can. Ent., V, 1873, p. 231; VII, 1875, pp. 105, 106; Conn. Quart. Journ. Sci., II, 1875, p. 289; Can. Ent., VIII, 1876, p. 19.

Epithectis attributella BUSCK, Dyar's List Amer. Lep., No. 5608, 1903.

Two of Chambers's types of *Gelechia difficilisella* (type no. 444) and specimens thus determined by Lord Walsingham are in the U. S. National Museum. They agree well with Chambers' description and were found identical with Chambers' types in the museum in Cambridge.

Lord Walsingham established the synonymy with Walker's species.

It is a very common species, collected by the writer in numbers on trunks of trees in Washington, District of Columbia.

Other specimens in the U. S. National Museum bear the following locality labels: Virginia, Maryland, Pennsylvania, and New York; the types came from Kentucky.

EPITHECTIS BICOSTOMACULELLA Chambers.

Gelechia bicostomaculella CHAMBERS, Bull. U. S. Geol. Surv., III, 1877, p. 127; IV, 1878, p. 141.—RILEY, Smith's List Lep. Bor. Am., No. 5322, 1891.

Epithectis bicostomaculella BUSCK, Dyar's List Amer. Lep., No. 5609, 1903.

Not *Gelechia bicostomaculella* DIETZ, Smith's List Ins. N. Jersey, 1900, p. 474; Busck, Dyar's List Amer. Lep., No. 5755, 1903.

Chambers had named another species *Depressaria bicostomaculella*¹ before describing this species, but changed that name later to *querceifoliella*,² when he discovered its food plant. This change was, of course, inadmissible, and the name *bicostomaculella* must be retained for that species, which is a true *Gelechia*, common in the Eastern States (p. 879). This, however, need not now interfere with the name of the present Colorado species, when it is transferred to *Epitheatis*, to which genus it was found to belong on examination of the type in the Museum of Comparative Zoology in Cambridge.

It is a very distinctly recognized species, of which, besides the type, I have seen only few specimens in Dr. Dietz's collection from Colorado like the type, and in U. S. National Museum from Arizona, collected by Messrs. E. A. Schwarz and H. S. Barber.

EPITHECTIS SYLVICOLELLA, new species.

Epitheatis sylvicolella Busck, Dyar's List Amer. Lep., No. 5610, 1903.

Antennæ dark fuscous, very indistinctly lighter annulated.

Labial palpi dark brown, second joint with apex and a narrow annulation below apex white; terminal joint with tip and two annulations white.

Face and head whitish, flecked with light brown.

Forewings, ground color white, thickly overlaid with dark fuscous. Three costal spots dark brown, nearly black, one at base, one just before the costal cilia, and one midway between these.

At the beginning of costal cilia is a whitish spot less overlaid with fuscous than the rest of the wing, and opposite on the dorsal margin is a similar but smaller spot. At basal third of dorsal margin is a short, transverse, oblique dark streak reaching the fold, on which it widens out to a small dark spot, sometimes more prominent than the streak and edged exteriorly with a few white scales.

On the middle of the disk is a blackish oblong dot edged with white, and at the end of the disk is a similar rather more prominent dot. Between and immediately below these dots is an oblong, longitudinal, dark-brown streak. At base of cilia, around costal, apical, and dorsal edge, is a row of equidistant dark-brown spots. Cilia yellowish fuscous. Hindwing light gray, with bluish reflections. Cilia yellowish. Legs yellowish, tarsi annulated with black.

Alar expanse.—15 mm.

Type.—No. 6358, U.S.N.M.

Habitat.—New York.

The types of this species were found in Fitch's collection, now in

¹Can. Ent., IV, p. 127.

²Idem., IV, p. 202.

the National Museum, and were labeled in his handwriting *Anacampsis sylvicolella*; hence the name.

EPITHECTIS SUBSIMELLA Clemens.

Parasia' subsimella CLEMENS, Proc. Acad. Nat. Sci. Phila., 1860, p. 173; Stainton Ed. N. Am. Tin., 1872, p. 137.

Parasia subsimella CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 160.—RILEY, Smith's List Lep. Bor. Am., No. 5588, 1891.

Epitheatia subsimella BUSCK, Dyar's List Amer. Lep., No. 5611, 1903.

Clemens' type is lost, but his generic characterization of this species shows that it must belong to the present genus.

A specimen in the U. S. National Museum, labeled by Lord Walsingham *Gelechia consinusella* Chambers, and which has a striking external similarity to that species, *Aprozema consinusella*, p. 844, but which on examination was found to be an *Epitheatia*, I have with but slight hesitation determined as the present species, with the description of which it agrees in all particulars.

EPITHECTIS SAUNDERSELLA Chambers.

Gelechia saundersella CHAMBERS, Can. Ent., VIII, 1876, p. 173; Bull. U. S. Geol. Surv., IV, 1878, p. 147.—RILEY, Smith's List Lep. Bor. Am., No. 5476, 1891.

Epitheatia saundersella BUSCK, Dyar's List Amer. Lep., No. 5612, 1903.

A specimen with Chambers' label on the pin is in the U. S. National Museum, which I have compared and found identical with Chambers' types in Cambridge Museum. It is a very small, conspicuously spotted species, easily recognized from the description. I have seen no other specimen, and I refer it with some hesitancy to the present genus, not being able to ascertain the venation with absolute certainty.

Habitat.—Kentucky.

EPITHECTIS GALLÆGENITELLA Clemens.

Gelechia gallægenitella CLEMENS, Proc. Ent. Soc. Phila., II, 1864, p. 420; Proc. Ent. Soc. Phila., III, 1865, p. 506; Stainton Ed. Tin. N. Am., 1872, pp. 242, 259.—CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 143.—RILEY, Smith's List Lep. Bor. Am., No. 5376, 1891.—DIETZ, Smith's Ins. N. Jersey, 1900, p. 474.

Gelechia geminella RILEY, Can. Ent., III, 1871, p. 195.—CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 143.—RILEY, Smith's List Lep. Bor. Am., No. 5379, 1891.

Epitheatia gallægenitella BUSCK, Dyar's List Amer. Lep., No. 5613, 1903.
Not *geminella* Linnæus.

The type of this species is lost, but I have no doubt it is the same species that Riley thought was the European *Stenolechia geminella* Linnæus. Both were bred from Cynipid galls on oak, and Clemens' description exactly fits Riley's specimen now in U. S. National Museum. There are also other specimens, bred by Miss Murtfeldt and by the writer from the same kind of galls.

PARALECHIA, new genus.

Plate XXX, fig. 18.

Antennae simple, rather thick, three-fourths as long as forewing. Labial palpi moderate, curved, ascending; second joint somewhat thickened beneath with rough scales; terminal joint shorter than second, pointed. Forewings elongate, ovate; apex bluntly pointed, dorsal edge slightly sinuate at vein 2; 12 veins, 7 and 8 stalked to costa, 6 separate; 3, 4, and 5 long approximate from end of cell, 2 distant shorter.

Hindwings narrower than forewings, elongate trapezoidal, termen slightly sinuate below apex; 8 veins, 6 and 7 parallel, 5 approximate to 4, 3 and 4 connate or short stalked.

Forewings with raised scales.

Only the following two species are at present known:

Forewings white and black *cristifasciella*, p. 820
Forewings brown *pinifoliella*, p. 820

PARALECHIA PINIFOLIELLA Chambers.

Gelechia pinifoliella CHAMBERS, Journ. Cinn. Soc. Nat. Hist., II, 1880, p. 181.—COMSTOCK, Rep. U. S. Ent. Comm., V, 1890, p. 793, fig. 269.—RILEY, Smith's List Lep. Bor. Am., No. 5448.

Aristotelia pinifoliella DIETZ, Smith's List Ins. N. Jersey, 1900, p. 475.

Paralechia pinifoliella BUSCK, Dyar's List. Amer. Lep., No. 5614, 1903.

Chambers type (No. 458) and a large bred series of this common moth are in the U. S. National Museum.

Habitat.—Atlantic States.

PARALECHIA CRISTIFASCIELLA Chambers.

Gelechia cristifasciella CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, pp. 87, 142.—RILEY, Smith's List Lep. Bor. Am., No. 5347, 1891.

Gelechia (Pecilia) inscripta WALSHINGHAM, Trans. Am. Ent. Soc. Phila., X, 1882, p. 180.

Gelechia inscripta RILEY, Smith's List Lep. Bor. Am., No. 5390, 1891.—DIETZ, Smith's List Ins. N. Jersey, 1900, p. 474.

Paralechia cristifasciella BUSCK, Dyar's List Amer. Lep., No. 5615, 1903.

In the Museum of Comparative Zoology in Cambridge there are two types of *cristifasciella*, received from Chambers and in good condition. They show conclusively that this species is the same as Walsingham's *inscripta*, an authentic specimen of which, labeled by the author, is in the U. S. National Museum. The descriptions also agree.

I have repeatedly bred this species from oak, where the larva and pupa are found between leaves spun together, but have unfortunately no serviceable description of the larva.

The moth from overwintered pupæ appears in April, and in July another generation is found as imago.

Habitat.—Eastern United States, Missouri, Kentucky.

PHTHORIMÆA Meyrick.

Plate XXX, fig. 19.

Phthorimæa MEYRICK, Entom. Mo. Mag., XXXVIII, 1902, p. 103.

Dr. Edward Meyrick has been so kind as to publish this well-founded genus, which has *Gelechia operculella* Zeller as type, in advance of his paper, so that it could be included in this revision.

It has the following characters: Labial palpi long, curved; second joint with heavy divided brush beneath; terminal joint nearly as long as second, somewhat thickened, with appressed scales, especially at base; apex pointed.

Forewings elongate ovate pointed; 12 veins, 7 and 8 stalked to costa, rest separate; hindwings as broad as forewings, apex pointed, termen sinuate below apex; 8 veins; 6 and 7 separate parallel, 5 nearest 4, 3 and 4 connate. In the males the basal half of costal edge forms a broad, shallow fold in which a large, expansible bunch of long, scale-like hairs find place when the insect is at rest.

The recognized American species may be separated thus:

- | | |
|---|-----------------------------|
| With longitudinal black streaks on forewings | <i>striatella</i> , p. 822 |
| Without such streaks | 1 |
| 1. With dark marking on outer half of costal edge | <i>marmorella</i> , p. 823 |
| Without such markings | 2 |
| 2. With distinct longitudinal ochreous streaks | <i>operculella</i> , p. 821 |
| Without such streaks | <i>glochirella</i> , p. 822 |

PHTHORIMÆA OPERCULELLA Zeller.

Gelechia terrella WALKER (not FISCHER v. RÖSTERSTAMM), Cat. Lep. Ins. Brit. Mus., XXX, 1864, p. 1024.

Gelechia (?) *Bryotropha*) *operculella* ZELLER, Verh. k. k. zool.-bot. Gesell. Wien, XXIII, 1873, p. 262.

Gelechia operculella, CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 145.—RILEY, Smith's List Lep. Bor. Am., No. 5434, 1891.—HOWARD, U. S. Dept. Agr., Farmers' Bull., No. 120, 1900, p. 23.

Bryotropha solanella BOISDUVAL, Journ. Soc. Cent. Hort. de France, 1874, VIII, p. 713.

Gelechia tabacella RAGONOT, Bull. Soc. Ent. France, 1879.

Gelechia solanella STAEDINGER and REBEL, Cat. Lep. Eur., II, No. 2636, 1901.

Phthorimæa operculella MEYRICK, Ent. Mo. Mag., XXXVIII, 1902, p. 103.—BUSCK, Dyar's List Amer. Lep., No. 5616, 1903.

While studying Zeller's types in the Museum of Comparative Zoology in Cambridge, during May, 1900, I decided that his *Gelechia operculella* was the same as the common tobacco and potato feeding Tineid, which had hitherto passed under the name *solanella* Boisduval. Zeller's types in Cambridge, which are in fine condition, leave no doubt thereon, and his description and figure further substantiate it.

However, I did not at the time wish to change the name of so well-known an insect entirely on my own observation, but was able, through the kindness of Mr. S. Henshaw, to submit one type (male) to Mr. E.

Meyrick, who, by return mail, pronounced it to be *solanella* Boisduval, which name must fall for the earlier one of Zeller.

Zeller described two females, which he associated with this species with some doubt; it seems evident from his remarks that these two female "types" are really another species, as Zeller himself surmised. They are, with one male, in the collection of Lord Walsingham.

The species, which likely has its original home in America, is now introduced in Europe, Africa, and Australia, and is of some economic importance, owing to the damage to tobacco and potato crops accomplished by it.

The different life modes on the two food plants, as leaf miner on tobacco and as borer in the potato, are equally well known and have been the subject of a large amount of literature in economic entomology, references to which are not attempted here. Among the most important are those of Dr. L. O. Howard.¹

In the U. S. National Museum are bred specimens compared by the writer with Zeller's types and many specimens determined by Lord Walsingham as *Gelechia solanella* Boisduval, besides a very large series bred from tobacco and potato in the insectary of U. S. Department of Agriculture.

PHTHORIMÆA GLOCHINELLA Zeller.

Gelechia glochinella ZELLER, Verh. k. k. zool.-bot. Gesell. Wien, XXIII, 1873, p. 263, pl. III, fig. 18.—CHAMBERS, Bull. U. S. Geol. Surv., III, 1878, p. 144.—RILEY, Smith's List Lep. Bor. Am.

Gelechia solaniella CHAMBERS, Can. Ent., V, 1873, p. 176; Cinn. Quart. Journ. Sci., II, 1875, p. 239.

Gelechia cinerella MURTFELDT, Can. Ent., XIII, 1881, p. 244.

Gelechia inconspicuellu MURTFELDT, Can. Ent., XV, 1883, p. 139.

Gelechia piscipellis RILEY (not ZELLER), Smith's List Lep. Bor. Am., No. 5450, 1891.

Phthorimæa glochinella BUSCK, Dyar's List Amer. Lep., No. 5617, 1903.

This is the smaller and plainer species bred by Miss Murtfeldt from *Solanum* and mixed up by Chambers with his *similiella* (p. 779). In the U. S. National Museum is a specimen named by Lord Walsingham *Gelechia glochinella*; also a large bred series received from Miss Murtfeldt.

The male genitalia as figured by Zeller is the surest distinguishing character from the preceding very similar species.

PHTHORIMÆA STRIATELLA Murtfeldt.

Eucatoptus striatella MURTFELDT, Can. Ent., XXXII, 1900, p. 163.

Phthorimæa striatella BUSCK, Dyar's List Amer. Lep., No. 5618, 1902.

Lord Walsingham determined this insect generically for Miss Murtfeldt and placed it in his West Indian genus *Eucatoptus*, but even if

¹ Insect Life, IV, p. 239, and Report United States Department of Agriculture, 1898, p. 137.

that genus would hold (p. 794) the present species could not be included, as it differs from Walsingham's characterization both in palpi and wing structure.

Types, received from Miss Murtfeldt (Missouri), are in U. S. National Museum, where there is also a large series bred from *Solanum* by Mr. D. W. Coquillett in Los Angeles, California.

PHTHORIMÆA MARMORELLA Chambers.

Gelechia marmorella CHAMBERS, Cinn. Quart. Journ. Sci., II, 1875, p. 239; Bull. U. S. Geol. Surv., IV, 1878, p. 144.—RILEY, Smith's List Lep. Bor. Am., No. 54061, 1891.

Phthorimæa marmorella BUSCK, Dyar's List Amer. Lep., No. 5619, 1903.

Two types of this species in poor condition are in the Museum of Comparative Zoology. They show it to be a species of *Phthorimæa* different from any other recognized species. I have not met with other specimens.

Habitat.—Kentucky.

GNORIMOSCHEMA Busck.

Plate XXX, fig. 20.

Gnorimoschema BUSCK, Proc. U. S. Nat. Mus., XXIII, 1900, p. 227.

Antennæ simple; labial palpi long curved, second joint large, with a well-developed, furrowed brush beneath; terminal joint shorter than second, more or less thickened with scales except at extreme tip, which is pointed and thin, laterally compressed,¹ front sharp, sometimes slightly serrate. Maxillary palpi obsolete. Tongue moderate scaled at base.

Anterior wings narrow, elongate, somewhat sinuate below apex, which is bent slightly downward.

Posterior wings a little broader than anterior wings; costa deflected downward from the middle of the wing; apex produced, termen sinuate, tornus rounded, dorsal edge straight.

Venation.—Forewings: 12 veins, 7 and 8 stalked, the rest separate. Hindwings: 8 veins, 3 and 4 connate, 5 approximate to 4, 6 and 7 parallel.

The species recognized as belonging to this genus may be separated by the following table:

With dorsal edge distinctively darker than costal edge.....	1
Dorsal edge not darker than costal edge	3
1. Head and palpi, pure white	<i>terraccottella</i> , p. 835
Head and palpi, not pure white.....	2
2. Dorsal edge, blackish	<i>serratifalpa</i> , p. 829
Dorsal edge, not blackish.....	<i>florella</i> , p. 832

¹ This is a better description than the original, given of third joint of the labial palpi; it is not scales, but the joint itself, which projects above the thickened part.

3. Dorsal edge, distinctly lighter than costal edge	4
Dorsal edge, not lighter than costal edge	10
4. Head unmottled brown	<i>baccharisella</i> , p. 825
Head not unicolorous brown	5
5. Head and palpi, whitish	6
Head and palpi, dark mottled	9
6. Ground color of forewing, light ochreous	<i>pallidochrella</i> , p. 828
Ground color, not ochreous	7
7. Forewings with dark streak on fold	<i>gallavasteriella</i> , p. 825
Forewings without such streak	8
8. Costal half of forewings, nearly unicolorous	<i>albinmarginella</i> , p. 827
Costal half of forewings, not unicolorous	<i>semicyclionella</i> , p. 828
9. Base of forewings, clear yellowish brown	<i>coquilletella</i> , p. 826
Base of forewing, not yellowish brown	<i>gallaeolidaginis</i> , p. 824
10. Forewings with large scale tufts on dorsal half	<i>dueliella</i> , p. 828
Forewings without scale tufts	11
11. Forewings with ocellate spots	12
Forewings without ocellate spots	14
12. Forewings with transverse fascia near base	<i>octomaculella</i> , p. 830
Forewings without such fascia	13
13. Forewings with longitudinal ochreous streaks	<i>ochreostrigella</i> , p. 831
Forewings without such streaks	<i>triocelella</i> , p. 830
14. Forewings with two oblique black lines crossing at basal third	<i>lavernella</i> , p. 833
Forewings without such lines	15
15. Forewing with longitudinal streaks	16
Forewing without longitudinal streaks	17
16. Streaks light yellow; two large black spots on disk	<i>collinusella</i> , p. 831
Streaks red; no large discal spots	<i>saphirinella</i> , p. 832
17. Ground color, whitish	18
Ground color, not whitish	19
18. Forewings uniformly dotted with dark scales	<i>tetradymella</i> , p. 834
Forewings not uniformly dotted with dark scales	<i>batanella</i> , p. 833
19. Forewings nearly unicolorous	20
Forewing strongly mottled	<i>banksiella</i> , p. 832
20. Forewings, brown	<i>pedmontella</i> , p. 829
Forewings, fuscous	<i>scutellariella</i> , p. 834

GNORIMOSCHEMA GALLÆSOLIDAGINIS Riley.

Gelechia gallaeolidaginis RILEY, Mo. Rep. Nat. Inst., I, 1869, p. 173; II, 1870, pp. 20, 132, 134; Smith's List Lep. Bor. Am., No. 5377, 1891.—CHAMBERS, Can. Ent., VIII, 1876, p. 19; IX, 1877, p. 14; Cinn. Quart. Journ. Sci., II, 1875, p. 289; Bull. U. S. Geol. Surv., III, 1877, pp. 1, 28, 141; IV, 1878, pp. 115, 143.—KELLCOTT, Can. Ent., X, 1878, p. 201.—DIETZ, Smith's List Inst. N. Jersey, 1900, p. 474.

Gnorimoschema gallaeolidaginis BUSCK, Proc. U. S. Nat. Mus., XXIII, 1900, p. 227; Dyar's List Amer. Lep., No. 5620, 1903.

Riley's type is still in perfect condition in the U. S. National Museum under type no. 452.

The species is recorded from Missouri (Riley), Colorado (Chambers), Michigan and New York (Kellicott), New Jersey (Beutenmüller), and has been reared repeatedly in large series by the writer in the District of Columbia and surrounding country.

Larva in stem-galls on *Solidago*. Imagos issue during autumn (September) and also overwinter.

GNORIMOSCHEMA GALLÆASTERIELLA Kellicott.

Gelechia galleasteriella KELLICOTT, Can. Ent., X, 1878, p. 203 — RILEY, Smith's List Lep. Bor. Am., No. 5378, 1891.

Gelechia gallediplopappi FYLES, Can. Ent., XXII, 1890, p. 248.—RILEY, Smith's List Lep. Bor. Am., No. 5375, 1891.

Gnorimoschema galleasteriella BUSCK, Dyar's List Amer. Lep. No. 5621, 1903.

An authentic bred specimen received from Mr. Kellicott is in the U. S. National Museum. Authentic bred specimens of *gallediplopappi* were kindly sent me by Rev. Dr. Fyles; they show this species to be the same as Kellicott's, as descriptions and food plant would indicate. It is like the foregoing, a large, somewhat variable, but easily recognized species, which is about as common around Washington as *galleosoliduginis*.

Habitat.—Michigan (Kellicott), Canada (Fyles), District of Columbia (Busck).

Larva feeds during summer in stem-gall on various species of *Aster*. Imagos issue during autumn and also overwinter.

GNORIMOSCHEMA BACCHARISELLA, new species.

Gnorimoschema baccharisella BUSCK, Dyar's List Amer. Lep., No. 5622, 1903.

Antennæ reddish brown, each joint with tip and two small dots on the middle above black. Labial palpi of pronounced *Gnorimoschema* form, reddish white with black shading on the outside of the second joint and at base and near tip of the terminal joint; extreme tip whitish.

Face, head, and thorax light clay brown, unmottled; basal one-sixth of forewings concolorous with thorax, with a small dark brown dot below costa at extreme base. In some specimens this yellow-brown color is continued, gradually fainter, along dorsal edge below fold. The rest of the wing is ochreous, thickly overlaid with dark fuscous scales, most numerous on the costal middle part of the wing and gradually becoming fewer toward apex, where the dark scales form narrow ill-defined longitudinal streaks on the yellow ground color. In the middle of the disk is a short oblong dark reddish-brown spot with black center, and at the end of the cell is a similar nearly moon-shaped spot.

Below the former on the fold are in some specimens a similarly colored reddish longitudinal spot.

There is some variation in the intensity of these spots and dark markings, some specimens appearing to the naked eye light reddish yellow with dark irregular longitudinal lines, while others appear dark

fuscous with narrow light streaks; around apical edge are a few blackish dots.

Hindwings shining silvery, cilia yellowish.

Abdomen robust, reddish yellow; females with stout straight protruding transparent ovipositor. Legs rather short, reddish white, shaded on the outside in irregular patches with black; tarsi blackish, with extreme tip of each joint white.

Alar expanse.—11–20 mm., the average size being 16 to 17 mm.

Habitat.—California.

Food plant.—*Baccharis pilularis*.

Type.—No. 6359, U.S.N.M.

Described from many specimens in perfect condition, bred and mounted by Mr. Koebele.

From Mr. Koebele's notes in the U. S. Department of Agriculture it is learned that he found the larvæ abundantly near San Francisco and in Berkeley County, California, in June on *Baccharis pilularis*. The larva makes a gall on the stem, and, according to Koebele, "they leave the galls when mature in the latter part of July and pupate in a case of silk in the sand."

It is not indicated in the notes whether this was under natural conditions or in his breeding cage. The moths issued September 15 to 26.

GNORIMOSCHEMA COQUILLETTELLA Busck.

Gnorimoschemella coquillettei Busck, Proc. U. S. Nat. Mus., XXV, 1902, p. 405; Dyar's List Amer. Lep., No. 5623, 1903.

Antennæ dark brown, with narrow silvery white annulations. Labial palpy of typical form; second joint whitish, sprinkled with brown scales and with a black bar on the outside; terminal joint black with a white annulation round the middle.

Face whitish; head and thorax whitish, heavily overlaid with dark brown.

Basal fifth of forewing light yellowish brown, which color is continued in a downward-curved streak along basal half of dorsal edge and sharply limited toward the rest of the wing. The ground color in the rest of the wing is pale bluish white, each scale tipped with black.

Adjoining the basal fawn-colored part is a costal semicircular region, heavily overlaid with dark fuscous, and outside this is another similar dark costal spot, not so well defined. In the first of these dark semicircles on the middle of the cell is a dark reddish brown dot surrounded with a few fawn-colored scales, and below the second costal semicircle at the end of the cell is another similarly edged spot. A few dark fuscous scales are sprinkled irregularly over the apical part of wing and the extreme apex is dark fuscous. Hindwing silvery fuscous,

darker along costa and toward the tip; cilia yellowish. Abdomen dark shining fuscous; legs whitish, shaded with dark fuscous.

Alar expanse.—11.5 to 14 mm.

Habitat.—California.

Food plant.—*Applopappus pinifolius*.

Type.—No. 6288, U.S.N.M.

Described from many specimens bred by Mr. Koebele and Mr. Coquillett.

This species resembles in general appearance the foregoing *baccharisella* Busck, but it is a smaller and neater colored insect, and easily distinguished by the mottled head and the clearer, lighter basal area.

Both are nearly related to the type of the genus.

I take pleasure in naming this species after Mr. D. W. Coquillett, who has generously given me his notes on this and a few other Californian Gelechiidæ.

Mr. Koebele's note on this insect is as follows:

Collected on *Bigelovia*? in the beginning of March, at Los Angeles, California, quite a number of larvæ, which spin the young leaves in the top together, so that it resembles a gall; in this they live, boring down into the stem half an inch to an inch, resembling in habits the *Parlusa* in tips of *Solidago*.

The larvæ, when full grown, left their tips and spun a cocoon on top of the ground; also on the side of the glass and on leaves.

Mr. Coquillett has kindly given me the following description of the larva from his notes:

Head yellowish brown, marked on each side with two blackish dots, of which the posterior one is nearly hidden by the first segment of the body; body dull pinkish white, sometimes tinged with brown on dorsum of abdomen; cervical shield pale yellowish; piliferous spots light colored; spiracles and anal plate concolorous with body; length, 10 mm.

Lives in a thin-walled oblong gall about 12 mm. long, formed of the undeveloped terminal bud on *Applopappus pinifolius*. Several galls, each containing a single larva, were found March 7, 1886, near Los Angeles, California; one of these larvæ pupated April 16 and the moth issued May 18. During the following year a gall containing a larva was found in the same locality, April 9, and the moth issued June 12.

GNORIMOSCHEMA ALBIMARGINELLA Chambers.

Gelechia albimarginella CHAMBERS, Cinn. Quart. Journ. Sci., II, 1875, p. 291.

Gelechia albomarginella CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 141.—

RILEY, Smith's List Lep. Bor. Am., No. 5305, 1891.

Gnorimoschema albimarginella BUSCK, Dyar's List Amer. Lep., No. 5624, 1903.

The unique type, labeled by Chambers in the Museum of Comparative Zoology, Cambridge, which, though not spread, is in fairly good condition, agrees with his description, and shows that the species belongs in this genus.

No other specimen is at present known to me.

Habitat.—Colorado.

GNORIMOSCHEMA SEMICYCLIONELLA, new species.

Gnorimoschema semicyclionella BUSCK, Dyar's List. Amer. Lep., No. 5625, 1903.

Antennæ white, sharply annulated with dark chocolate brown. Labial palpi whitish, suffused with brown except tip and annular around middle of terminal joint, which are clear white. Face and head white, lightly sprinkled with brown scales; thorax darker, more liberally sprinkled with brown. Forewings white with a faint reddish tint, thickly sprinkled with minute bluish black atoms, each scale being tipped with black. Near base of wing is a clear, light chocolate brown patch; before middle of wing is a large chocolate brown semicircular costal spot, reaching down over the fold and edged with lighter brown and white below and with pure white toward the brown basal area. Following and adjoining this costal spot is another smaller and less well-defined semicircular brown costal spot, and toward the tip in the middle of the wing is an obscure brown patch. Cilia brownish white. Hindwing light silvery gray, darker along costa and toward the tip; cilia yellowish. Abdomen dark chocolate brown, the two first joints above velvety yellowish, and tip of male anal tuft white. Legs whitish, sprinkled and shaded with dark brown; tarsi blackish, each joint tipped with white.

Alar expanse.—12 to 14 mm.

Habitat.—Colorado, New Mexico.

Type.—No. 6360, U.S.N.M.

I am indebted to Dr. Dietz for one of the specimens from which I have described this species; another was collected by Mr. H. S. Barber at Las Vegas, New Mexico.

GNORIMOSCHEMA PALLIDORELLA Chambers.

Depressaria pallidorella CHAMBERS, Can. Ent., IV, 1872, pp. 126, 129, 147, 148; Bull. U. S. Geol. Surv., III, 1878, p. 138.—RILEY, Smith's List Lep. Bor. Am., No. 5272, 1891.

Gelechia pallidorella CHAMBERS, Bull. U. S. Geol. Surv., 1878, p. 145.—RILEY, Smith's List Lep. Bor. Am., No. 5439, 1891.

Gnorimoschema pallidorella BUSCK, Proc. U. S. Nat. Mus., XXIV, 1902, p. 732; Journ. N. Y. Ent. Soc., X, 1902, p. 90 note; Dyar's List Amer. Lep., No. 5626, 1903.

The unique type of this species is found in the museum in Cambridge. It is in poor condition, but shows plainly that it belongs in the present genus. I have met with no other specimen.

Habitat.—Kentucky.

GNORIMOSCHEMA DUDIELLA, new species.

Gnorimoschema dudiella BUSCK, Dyar's List Amer. Lep., No. 5627, 1903.

Labial palpi of pronounced *Gnorimoschema* form, white thickly sprinkled with black, under side of brush black. Antennæ whitish gray, annulated with black, basal joint black. Face silvery, head

and thorax bluish white, liberally sprinkled with black and dark fuscous scales. Forewings elongate slender, apex deflexed; ground color bluish white, but so thickly overlaid with black and fuscous as to appear dark, each scale being mottled with white and black or dark fuscous. On the basal and apical one-third the light color prevails so as to make these parts light pearl gray to the naked eye; the middle part of the wing appears without a lens blackish, but under a lens is disclosed the composite coloration. On the middle of the cell is a short deep black perpendicular dash slightly edged with brown scales; at the end of the cell is another similar larger oblique velvety black dash, also edged with light brown. Parallel with the dorsal edge and just within this is a row of three equidistant large tufts of erect scales. Hindwings dark fuscous, cilia a shade lighter. First two abdominal segments are light ochreous above, rest of abdomen light iridescent gray; legs light gray on the inside, black on the outside; tarsal joints slightly tipped with white.

Alar expanse.—15 to 17.2 mm.

Habitat.—Arizona.

Type.—No. 6361, U.S.N.M.

Described from two perfect females collected and spread by Mr. H. S. Barber in June and July, 1901.

GNORIMOSCHEMA SERRATIPALPELLA Chambers.

Gelechia serratipalpella CHAMBERS, Bull. U. S. Geol. Surv., III, 1877, p. 123; Bull. U. S. Geol. Surv., IV, 1878, p. 147.—RILEY, Smith's List Lep. Bor. Am., No. 5479, 1891.

Gnorimoschema serratipalpella BUSCK, Dyar's List Amer. Lep., No. 5628, 1903.

Type of this easily recognized species is found in the Museum of Comparative Zoology, where I have examined it and compared it with an identical specimen from Las Vegas, New Mexico, belonging to the National Museum.

I have also examined and received identical specimens from Dr. Dietz, collected at Denver, Colorado, from where Chambers' type came.

This species represent the extreme development of the genus, having the distinguishing palpal characters accentuated, as described by Chambers.

GNORIMOSCHEMA PEDMONTELLA Chambers.

Gelechia pedmontella CHAMBERS, Bull. U. S. Geol. Surv., III, 1877, p. 123; Bull. U. S. Geol. Surv., IV, 1878, p. 145.—RILEY, Smith's List Lep. Bor. Am., No. 5444, 1891.

Gnorimoschema pedmontella BUSCK, Dyar's List Amer. Lep., No. 5629, 1903.

Chambers' type in Cambridge examined and found identical with specimens in the U. S. National Museum from Denver, Colorado, received through Dr. Dietz. The type came from Colorado. I have seen no other specimen.

GNORIMOSCHEMA TRIOCELLELLA Chambers.

Glecehia triocellella CHAMBERS, Bull. U. S. Geol. Surv., III, 1877, p. 127.

Glecehia triocellella CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, pp. 87 and 147.—

RILEY, Smith's List Lep. Bor. Am., No. 5501, 1891.—DIETZ, Smith's List Ins. New Jersey, 1900, p. 474.?

Gnorimoschema triocellella BUSCK, Dyar's List Amer. Lep., No. 5630, 1903.

A well-preserved series of types with Chambers' written labels attached are found in the Museum of Comparative Zoology.

In the U. S. National Museum are several specimens, compared with and found identical with the types by the writer in 1900. One of these is named by Lord Walsingham; others were received from Dr. Dietz.

All are from Colorado, as also are Chambers' types.

Chambers recorded a variety from Kentucky, with which I am not acquainted.

Dr. Dietz recorded "a very close variety" from New Jersey, but I think it improbable that it really was this Western species.

It is a typical *Gnorimoschema*.

GNORIMOSCHEMA OCTOMACULELLA Chambers.

Glecehia octomaculella CHAMBERS, Conn. Quart. Journ. Sci., II, 1875, p. 291; Bull.

U. S. Geol. Surv., III, 1877, p. 128; IV, 1878, p. 145.—RILEY, Smith's List Lep. Bor. Am., No. 5432, 1891.

Gnorimoschema octomaculella BUSCK, Dyar's List Amer. Lep., No. 5631, 1903.

The unique type of this species is in the Museum of Comparative Zoology. It is in very poor condition, so poor that I did not at all recognize the very charming species it really is and described it in manuscript from a fine specimen in National Museum, bred by Mr. Koebele. However, on final examination last January I realized this. Chambers' meager description gives a very poor idea of the true appearance of a perfect specimen.

For this reason I append my description:

Antennæ reddish white, each joint annulated with black. Labial palpi of typical *gnorimoschema* form, whitish, sprinkled with black atoms; terminal joint just before the tip nearly black. Face reddish white, head and thorax reddish white, sprinkled with small dark atoms. Forewings pale rosy white, each scale tipped with black; near base of wing a transverse dark rust brown fascia, narrowly edged on both sides with light yellowish brown. (This fascia is not mentioned by Chambers, though detectable in the type.)

On middle of cell are two large circular dark rust-brown spots, one above the other, edged with lighter brown. A somewhat smaller similar spot at the end of the cell. Toward apex a few scattered all black scales; extreme apical edge black; cilia dirty white. Hindwings light silvery gray, cilia yellowish. Abdomen dark silvery fuscous except third joint, which is velvety yellow above; underside silvery

white. Legs white, sprinkled with dark brown scales; tarsi dusky with end of each joint white.

Alar expanse.—12 mm.

Food plant.—*Acemtopappus sphurocephalus*.

According to the notes of Mr. Koebele in the U. S. Department of Agriculture:

This species forms a gall-like swelling on tips of branches of the above plant. Larva were collected at Lancaster, California, in May; moth in June 26.

As can be seen from the above description, the name *octomaculella* is not appropriate and caused only by the poor condition of Chambers' type of this exquisite little insect.

GNORIMOSCHEMA HENSHAWIELLA Busck.

Gelechia ochreostrigella CHAMBERS, Bull. U. S. Geol. Surv., III, 1877, p. 126.

Gnorimoschema ochreostrigella BUSCK, Dyar's List Amer. Lep., No. 5632, 1903.

Not *Gelechia ochreostrigella* CHAMBERS, Cinn. Quart. Journ. Sci., II, p. 247; Can. Ent., X, 1878, p. 50; Bull. U. S. Geol. Surv., IV, 1878, p. 145.—RILEY, Smith's List Lep. Bor. Am., No. 5431, 1891.

Chambers described two different insects as *Gelechia ochreostrigella*. The first one from California is a very distinct true *Gelechia*, as the type in Cambridge proves; this species will be found treated under its proper genus [p. 869].

The other species is the present, an entirely different smaller insect, three types of which were found in the Museum of Comparative Zoology, one of which, through the courtesy of Mr. S. Henshaw, was secured for the U. S. National Museum.

It is a typical easily recognized *Gnorimoschema*; I take pleasure in forming the new name required for this species in honor of my friend, Mr. Samuel Henshaw, of Cambridge.

The species bears a close resemblance to *Phthorimaea operculella* Zeller.

There is no references to this species in Chambers' Index.

No other specimens besides the three types are known to me.

Type.—No. 6362, U.S.N.M.

Habitat.—Colorado.

GNORIMOSCHEMA COLLINUSELLA Chambers.

Gelechia collinusella CHAMBERS, Bull. U. S. Geol. Surv., III, 1877, p. 128; Bull.

U. S. Geol. Survey, IV, 1878, p. 142, 1878.—RILEY, Smith's List Lep. Bor. Am., No. 5339, 1891.

Gnorimoschema collinusella BUSCK, Dyar's List Am. Lep., No. 5633, 1903.

The unique type of this striking species, labeled by Chambers, is in Cambridge Museum. I have examined it carefully, and it belongs without doubt to this genus.

It is an easily recognized, large, light yellow species, but I have not met with other specimens.

Habitat.—Colorado.

GNORIMOSCHEMA SAPHIRINELLA Chambers.

Gelechia saphirinella CHAMBERS, Cinn. Quart. Journ. Sc., 11, 1875, p. 250.

Gelechia saphirinella CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 147.—RILEY, Smith's List Lep. Bor. Am., No. 5473, 1891.

Gnorimoschema saphirinella BUSCK, Dyar's List Am. Lep., No. 5634, 1903.

The two authentic types in the Museum of Comparative Zoology in Cambridge are in bad condition, but recognizable.

I have taken a few specimens of what I believe is this species at light in District of Columbia.

It was described from Colorado.

GNORIMOSCHEMA FLORELLA, new species.

Gnorimoschema florella, BUSCK, Dyar's List Amer. Lep., No. 5635, 1903.

Antennæ pale reddish with narrow deep black annulations. Labial palpi reddish white, darker and sprinkled with black on the under-side; terminal joint brick red with tip black. Face and tongue ochereous white; head and thorax pale reddish. Costal half of forewings whitish yellow sprinkled with light ochereous brown scales; dorsal half of forewings brick red. At basal third is a small black costal spot; on middle of cell is small black dot, below and nearer base another similar dot on the fold, and at the end of the cell is a third; all of these are surrounded by a circlet of whitish scales.

A few black scales are scattered irregularly on the wing, especially in the dorsal part and around the apical edge. Hindwings shining whitish fuscous, cilia reddish. Underside of body whitish; legs ochereous, barred with black; tarsal joints black, tipped with white.

Alar expanse.—17 mm.

Habitat.—Denver, Colorado.

Type.—No. 6363, U.S.N.M.

This striking species, very distinct from any other recognized species, was received from Dr. William Dietz.

GNORIMOSCHEMA BANKSIELLA, new species.

Gnorimoschema banksiella BUSCK, Dyar's List Amer. Lep., No. 5636, 1903.

Antennæ dark fuscous with narrow silvery annulations. Labial palpi dark fuscous, nearly black, upper side of second joint and tip of terminal joint whitish. Face light silvery gray; head and thorax dull dark fuscous nearly black; forewings concolorous with thorax with two round ochereous brown spots, one on middle of cell one at end of cell. Below on fold is a similarly colored diffused oblong spot touching the first discal spot and reaching down to the dorsal edge.

Apical part of wing more or less sprinkled with white scales. Hindwings light fuscous. The two first abdominal segments velvety yellow above, rest of abdomen blackish above, light silvery fuscous below; legs dark fuscous, each joint tipped with silvery white.

Alar expanse.—12 to 13 mm.

Habitat.—Northern Atlantic States.

Type.—No. 6364, U.S.N.M.

Described from several specimens collected by Mr. Nathan Banks, after whom I have pleasure in naming this species, at Sea Cliff, New York. In the National Museum are also specimens from Essex County, New York (Kearfott), and I have seen other specimens from Pennsylvania and Massachusetts. This is presumably the species identified by Dr. Dietz as a variety of *triocellella* Chambers, to which it comes quite near. It differs, however, in the lack of the ocellate spots, and is a much darker species than *triocellella*, which also has an angulated light fascia at apical third, lacking in *banksiella*.

GNORIMOSCHEMA BATANELLA, new species.

Gnorimoschema batanella Busck, Dyar's List Amer. Lep., No. 5637, 1903.

Antennæ silvery white, with sharp black annulations; labial palpi with second joint white, overlaid with dark fuscous, especially on the outside; terminal joint white, with base and ill-defined annulus before the tip dark fuscous; face whitish; head and thorax white, liberally sprinkled with light fuscous scales; forewings white, with a faint rosy tint, irregularly and sparsely sprinkled with black scales, especially toward the edges; a rather prominent group of them is found on costa at apical third. On the middle of the disk is a small light-brown spot; another similar is at the end of the cell. On the middle of the dorsal edge is a patch of brown, and between this and apex are two other small groups of brown scales. All of these brown markings are obscure, ill defined, and not constant in all specimens. The black scales form a nearly continuous thin line at base of cilia round the apical edge. Cilia white; hindwings dark, shining fuscous; cilia yellowish; abdomen dark fuscous above, silvery white below; legs white on the outside, sprinkled with fuscous; tarsi on the outside black, with each joint tipped with white, on the inside pure white; outer spurs black, inner spurs black on the outside, white on the inside.

Alar expanse.—11.5 to 12.5 mm.

Habitat.—New Jersey.

Type.—No. 6365, U.S.N.M.

Cotypes in the collection of Mr. William D. Kearfott, to whom the U. S. National Museum is indebted for the types.

GNORIMOSCHEMA LAVERNELLA Chambers.

Gelechia lavernella CHAMBERS, Can. Ent., VI, 1874, p. 242.—RILEY, Smith's List Lep. Bor. Am., No. 5400, 1891.

Gelechia phycodivorella CHAMBERS, Conn. Quart. Journ. Sci., II, 1878, p. 238; Bull. U. S. Geol. Surv., IV, 1878, pp. 117 and 146.—RILEY, Smith's List Lep. Bor. Am., No. 5447, 1891.

Gnorimoschema lavernella Busck, Dyar's List Amer. Lep., No. 5638, 1903.

No authentic specimen of *laevnella* is found in any of the American collections, but in U. S. National Museum was a specimen which had Professor Riley's label, "*laevnella*," on the pin. This specimen was evidently received from and mounted by Chambers, and agrees with bred specimens of *physalivorella*, compared with the type in Cambridge, which also exhibit the peculiar dark crossing lines on forewing described by Chambers.

I believe the two names apply to the same species.

Larva feeds in the fruits of *Physalis*.

Habitat.—Texas, Missouri (Chambers), Michigan, District of Columbia.

GNORIMOSCHEMA SCUTELLARIÆELLA Chambers.

Cletochloa scutellaricella CHAMBERS, Can. Ent., V, 1873, p. 175; Bull. U. S. Geol. Surv., IV, 1878, pp. 116, 147.—RILEY, Smith's List Lep. Bor. Am., No. 5477, 1891.

Gnorimoschema scutellaricella BUSCK, Dyar's List Amer. Lep., No. 5639, 1903.

I have examined the unique type of this species in the Museum of Comparative Zoology in Cambridge. It is in poor condition, but I feel certain that it is a true *Gnorimoschema*, and the knowledge of the food plant should easily enable the recognition of this small, inconspicuous, nearly unicolorous, dark fuscous species.

Food plant.—*Scutellaria lateriflora*.

Habitat.—Kentucky.

I have not met with other specimens than the type.

GNORIMOSCHEMA TETRADYMIELLA, new species.

Gnorimoschema tetradymiella BUSCK, Dyar's List Amer. Lep., No. 5640, 1903.

Antennæ dark fuscous, toward the tip whitish. Labial palpi dirty white, second joint shaded with black on the outside, terminal with a black spot at base.

Face, head, and thorax whitish, sprinkled with light fuscous. Anterior wings whitish, evenly and thickly overlaid with gray and fuscous scales giving the appearance of "pepper and salt." Toward the apex the veins are slightly indicated by nearly unsprinkled whitish thin lines, with their interspaces rather more overlaid with dark scales than the rest of the wing. Cilia ashy gray. Hindwings nearly transparent, light gray with silvery reflections; cilia yellowish. Abdomen dark shining fuscous, the two first joints velvety, yellowish above. Legs white, slightly sprinkled with dark fuscous.

Alar expanse.—15.5 to 20 mm.

Habitat.—Los Angeles, California.

Food plant.—*Tetradymia canescens*.

Type.—No. 6366, U.S.N.M.

Described from specimens bred by Mr. Koebele, from whose notes

it is learned that the larvæ live in stem-galls on the above plant and that the imago issued September 18 to 23.

GNORIMOSCHEMA TERRACOTTELLA Busck.

Gnorimoschema terracottella Busck, Proc. U. S. Nat. Mus., XXIII, 1900, p. 227, pl. I, fig. 3, Dyar's List Amer. Lep., No. 5641, 1903.—DYAR, Proc. Ent. Soc. Wash., IV, 1901, p. 471.

This striking species is easily distinguished from all others in the genus by its pure white head and costal markings.

Food plant.—*Ira imbricata*.

Habitat.—Palm Beach, Florida (Dyar).

Type.—No. 4934. U.S.N.M.

NEODACTYLOTA, new genus.

Plate XXX, figs. 21, 22, 23.

Type, *Dactylota snellenella* Walsingham.

As observed by Lord Walsingham,¹ his species described as *Dactylota snellenella* differs in several important characters from the type of *Dactylota* Snellen (*Didactylota* Walsingham.) I am now able to add a congeneric species, and it is proper to erect a separate genus for the American forms, which have the following characters: Labial palpi long, slender, recurved; second joint slightly thickened beneath with nearly smoothly appressed scales; terminal joint much longer than second, smooth, slender-pointed. Forewings narrow, elongate ovate, pointed; 12 veins, 7 and 8 stalked to costa, rest separate. Hindwings in male as broad as forewings, bilobed, costal and dorsal edge nearly parallel, apex produced, pointed, termen deeply emarginate below apex, forming a shorter obtuse second lobe; costal vein straight, connected by short oblique crossbar to the subcostal at basal third; veins 6 and 7 stalked; cell not closed; discal vein and veins 4 and 5 obsolete, the latter only slightly indicated by faint traces. The females are unknown to me, but, according to Lord Walsingham, they have not bilobed hind wings, though termen is deeply emarginate below the apex, and the discal vein is present, as well as veins 4 and 5, which are stalked. His lordship has kindly, through Mr. J. H. Durrant, sent me a sketch of the venation of the hindwing in the female, which is reproduced. (Plate XXX, fig. 22.)

The West Indian species, *Didactylota bicolor* Walsingham, will quite surely be found not to belong to this genus, but to *Nealyda* Dietz.

At present only the following two species are recognized, which may be easily separated, thus:

Forewings light gray.....	1, <i>snellenella</i> , p. 836
Forewings dark purplish brown.....	2, <i>harberella</i> , p. 836

¹ Insect Life, I, pp. 83, 84.

NEODACTYLOTA SNELLENELLA Walsingham.

Dactyloia snellenella WALSINGHAM, Ins. Life, I, 1888, p. 83.—RILEY, Smith's List Lep. Bor. Am., No. 5210, 1891.

Didactyloia snellenella WALSINGHAM, Proc. Zool. Soc. Lond., 1891, p. 522; 1897, p. 523.—BUSCK, Proc. U. S. Nat. Mus., XXIII, 1900, p. 228, pl. 1, fig. 4.

Neodactyloia snellenella BUSCK, Dyar's List Amer. Lep., No. 5643, 1903.

One male cotype received from Lord Walsingham is in the National Museum, from which Plate XXX, fig. 21 is drawn.

In a letter of October, 1900, Lord Walsingham has kindly criticised my delineation of this species,¹ calling my attention to the faint traces of veins 4 and 5, which are still more noticeable in the following species [Plate XXX, fig. 23], and later he sent me the sketch of the female hindwing, which is reproduced in Plate XXX, fig. 22.

I have met with no other specimen of this species, which was described from Arizona.

NEODACTYLOTA BARBERELLA, new species.

Neodactyloia barberella BUSCK, Dyar's List Amer. Lep., No. 5644, 1903.

Antennæ four-fifths as long as forewings, dark purple, nearly black, with a white longitudinal scale on each joint, forming an interrupted silvery white line from base to tip. Labial palpi long, slender, recurved; second joint thickened somewhat with smooth appressed scales, purplish black, mottled with silvery white scales; terminal joint long, thin, acutely pointed, black, sprinkled with sparse white scales. Tongue robust, covered with scant silvery scales.

Face, head, and thorax dark purplish brown. Forewings narrow, pointed; basal two-thirds dark purplish brown overlaid with evenly mixed black, red, and whitish scales. At apical third is a transverse, somewhat irregular and not very clearly defined narrow white fascia, outside of which the wing is lighter reddish brown, with strong purplish reflexions. Just outside the fascia on the costal edge is a small longitudinal shining salmon red dash; cilia dark purplish gray, with sparse black scales intermixed at base.

Hindwings as broad as forewings, bilobed, termen deeply excised beneath apex, which forms the upper long narrow-pointed lobe; the lower lobe is much shorter, broad, rounded, and blunt. Color, dark shining purplish gray; cilia lighter gray.

Abdomen, above, dark purplish brown; below, sprinkled with white scales.

Legs purplish, much sprinkled with white scales; tarsi purplish black, with each joint tipped with white.

Alar expanse.—14 mm.

Habitat.—Williams, Arizona.

¹Proc. U. S. Nat. Mus., XXIII, pl. 1, fig. 4.

Type.—No. 6367, U.S.N.M.

Collected May 27, 1901, by Mr. Herbert S. Barber, after whom this interesting and beautiful species is named.

DEOCLONA, new genus.

(Type, *Deoclona yuccasella* Busck.)

Antennæ four-fifths as long as forewing simple; labial palpi with second joint long, curved, cylindrical thickened with even, smoothly appressed scales, abruptly cut off at apex; terminal joint very short, less than one-fourth of second, tapering pointed. Head and thorax smooth. Forewing elongate, fully four times as long as wide, costal and dorsal edges parallel, apex rounded blunt; 12 veins, 7 and 8 stalked to costa, rest separate; 1^b shortly furcate at base. Hindwings as broad as forewings, elongate trapezoidal, costa nearly straight, slightly depressed from basal third, termen straight; apex blunt; 7 veins, 5 absent, discal vein, except a remnant of the lower end, obsolete, 3 and 4 long stalked, 6 and 7 stalked. Males and females are alike. Only the following species is at present recognized.

DEOCLONA YUCCASELLA, new species.

Deoclona yuccasella Busck, Dyar's List Amer. Lep., No. 5645, 1903.

Antennæ light yellow, with narrow brown annulations. Labial palpi light yellow. Face, head, and thorax light reddish yellow, a shade darker than the forewings, which are also unicolorous light reddish yellow, without any markings. In some specimens the forewings are slightly darker and more reddish toward apex than on basal half. Cilia yellowish white. Hindwings pale silvery yellow; cilia yellowish white. Abdomen yellow; legs pale yellow, without darker annulations; tarsi and tuft on posterior tibial whitish.

Alar expanse.—16.2 to 20 mm.

Habitat.—California.

Food plant.—*Yucca whipplei*.

Type.—No. 6368, U. S. N. M.

Described from six specimens bred by Mr. Koehle. The following is his note on the larva:

The larva lives in the dry seed pods, pupating in holes eaten therein, and moth issues therefrom in May. The seed pods were collected on the foothills, 16 miles east of Los Angeles, California.

PROSTOMEUS, new genus.

Type, *Prostomeus brunneus* Busck.

Plate XXXI, Fig. 25.

Antennæ 3, simple. Labial palpi long curved, strongly laterally compressed, sharp edged; second joint thickened above and below with appressed scales, abruptly cut off at apex, sharp edged in front;

terminal joint fully as long as second joint, strongly laterally compressed, sharp edged in front and behind, thickened with smoothly appressed scales, which terminate abruptly just before apex, leaving the acute tip projecting. Maxillary palpi obsolete. Tongue robust, spiraled, scaled at base. Forewings elongate, about four times longer than broad; costal and dorsal edge parallel; apex obtusely pointed; 12 veins, 7 and 9 stalked to costa, rest separate. Hindwings broader than forewings. Costa nearly straight, parallel with dorsal edge; apex obtuse, termen hardly sinuated, tornus and dorsal angle rounded; 8 veins, 6 and 7 stalked, 5 approximate to 4, 3 and 4 connate, 2 distant.

Allied to and resembling *Glyphidocera* Walsingham, but with simple antennæ and 12 veins in forewing, and easily recognized by the peculiar blade-like labial palpi.

Besides the species here described there is in the U. S. National Museum a single specimen of another species belonging to this genus, but not sufficiently well preserved to describe.

PROSTOMEUS BRUNNEUS, new species.

Prostomeus brunneus BUSCK, Dyar's List Amer. Lep., No. 5646, 1903.

Antennæ dark reddish brown, annulated with white. Labial palpi light brown, mottled with dark-brown and black scales; terminal joint with base, an annulus round the middle and apical third black. Head and thorax dark brown. Forewings light straw colored, overlaid with reddish brown; base dark purplish brown; along middle of costa from basal fourth to apical third a dark purplish brown oblong narrow patch. On the dorsal edge a larger similar patch, projecting up in the light middle part of the wing a boot-shaped figure, with the toe on the center of the cell, and the heel midway between this and a unicolorous circular spot at the end of the cell.

The region at tornus is dark brown, and the apical veins are slightly indicated by darker brown streaks. Around apex at base of the cilia is a row of dark, purplish-brown dots. Cilia brown.

Hindwings dark steel gray, lighter toward the base; cilia a shade lighter.

Abdomen dark purplish fuscous above; entire body light reddish yellow below. Legs light brown, annulated with black; tarsi black, with tip of each joint white.

There is some variation in the shade of the brown color in the different specimens, some being more reddish, others more yellowish, but the form of the markings seems constant.

Alar expanse.—15 to 15.5 mm.

Habitat.—Florida.

Type.—No. 6369, U.S.N.M.

Described from several specimens received from Wm. Beutenmüller.

POLYHYMNO Chambers.

Plate XXXI, fig. 26.

Polyhymno CHAMBERS, Can. Ent., VI, 1874, p. 246

This genus, of which *Polyhymno luteostrigella* Chambers is the type, has the following characters: Labial palpi recurved, very long, slender, second joint slightly thickened with smoothly appressed scales, terminal joint as long or longer than second, pointed. Forewings narrow, elongate, caudate, the costal and dorsal edge both slightly excised before the tip, which is produced and hooked a little downward, 12 veins, 7 and 8 very long-stalked; or 11 veins, 7 and 8 coincident. Hindwings nearly as broad as forewings, elongate, apex produced, termen sinuate; 8 veins, 3 and 4 shortstalked, 5 approximate to 4, 6 and 7 longstalked; transverse vein nearly obsolete.

This characteristic genus has been recorded by Lord Walsingham from the West Indies and from Africa; in America it is a southern genus attached to leguminous food plants.

Only three species have been described from this continent; these may be separated as follows:

- Forewings with longitudinal spindle formed white streak, vein 8 present. 1
 Forewings without such streak, vein 8 absent *P. seastrigella*, p. 840
 1. Forewings with dorsal edge white *luteostrigella*, p. 839
 Forewings with dorsal edge dark *acaciella*, p. 839

POLYHYMNO LUTEOSTRIGELLA Chambers.

Polyhymno luteostrigella CHAMBERS, Can. Ent., VI, 1874, p. 247; Bull. U. S. Geol. Surv., IV, 1878, p. 161; Journ. Cinn. Soc. Nat. Hist., II, 1880, p. 203, fig. 26.—BEUTENMULLER, Ain. Ent., V, 1889, p. 37.—WALSINGHAM, Trans. Ent. Soc. Lond., 1891, pl. VII, fig. 78; Proc. Zool. Soc. Lond., 1897, p. 77.—RILEY, Smith's List Lep. Bor. Am., No. 5586, 1891.—BUSCK, Jour. N. Y. Ent. Soc., VIII, 1900, p. 236; Dyar's List Amer. Lep., No. 5647, 1903.
Polyhymno fuscostrigella CHAMBERS, Can. Ent., VIII, 1876, p. 30.

Of this easily recognized and elegant species the U. S. National Museum possesses two specimens labeled by Lord Walsingham and a good series bred by the writer in the District of Columbia. In localities where the food plant is found this species comes readily to light.

Food plant.—*Cassia chamaecrista*.

Habitat.—Texas, Florida, District of Columbia.

POLYHYMNO ACACIELLA Busck.

Polyhymno acaciella BUSCK, Jour. N. Y. Ent. Soc., VIII, 1900, p. 235, pl. IX, fig. 1; Dyar's List Amer. Lep., No. 5648, 1903.

(This is a larger and darker species than the type of the genus, which it otherwise much resembles.

Food plant.—*Acacia farnesiana*.

Habitat.—Texas.

Type.—No. 5363, U. S. N. M.

POLYHYMNO SEXSTRIGELLA Chambers.

Polyhymno sexstrigella CHAMBERS, Can. Ent., VI, 1874, p. 248; Bull. U. S. Geol. Surv., IV, 1878, p. 161.—RILEY, Smith's List Lep. Bor. Am., No. 5587, 1891.—BUSECK, Journ. N. Y. Ent. Soc., VIII, 1900, p. 236; Dyar's List Amer. Lep., No. 5649, 1903.

One specimen in the U. S. National Museum named by Lord Walsingham I have compared and found identical with Chambers' type in the Museum of Comparative Zoology in Cambridge.

The venation of this species differs from that of the type of the genus only in the forewing, where vein 8 is absent, coincident with 7, which is very nearly the case in the other species also, where the stem of the fork of 7 and 8 is very long and the branches short.

The other differences in venation mentioned by Chambers are not borne out by the specimens, and the identical wing form and other characters place the species naturally in the same genus.

Habitat.—Texas.

APROÆREMA Durrant.

Plate XXXI, fig. 27.

Aproaerema DURRANT, Ent. Mo. Mag., XXXIII, 1897, p. 221.

Labial palpi very long, curved, second joint smooth, terminal joint longer than second, pointed. Forewings narrow, elongate pointed; 12 veins, 7 and 8 stalked, 6 sometimes out of 7 near base. Hindwings narrower than forewings, elongate trapezoidal, apex produced, pointed, termen emarginate; 8 veins, 6 and 7 stalked, 3 and 4 connate, 5 approximate to 4.

Lord Walsingham pointed out¹ that the name *Anacampsis* hitherto had been applied erroneously to this genus instead of to the genus known as *Tachyptilia* Heinemann, containing the type of *Anacampsis*, *Tinea populella* Clerck, as specified by Curtis.² Mr. Durrant therefore proposed the name *Aproaerema* for the genus thus left nameless, the type of which is *anthyllidella* Hübner.

The genus is developed from *Anacampsis*, Curtis (*Tachyptilia* Heinemann), with a section of which it has great similarity in coloration, but it is easily distinguished by the sinuate hindwings.

All the species feed on leguminous plants.

I have recognized the following American species which may be separated by the table:

Forewings black or nearly so	1
Forewings lighter	4
1. Labial palpi with longitudinal white lines	2
Labial palpi without such lines	3

¹ Proc. Zool. Soc. Lond., 1897, p. 79.

² Br. Ent., 1827, Expl., pl. clxxxix.

- 2 Forewings sprinkled with bluish-white scales.....*crotolariella*, p. 841
 Forewings without such light scales..... *palpiliniella*, p. 841
 3. With curved white fascia on middle of forewings..... *kerfottella*, p. 842
 Without such fascia.....*nigrella*, p. 842
 4. Forewings ochereous white.....*nigratomella*, p. 843
 Forewings fuscous.....*conchusella*, p. 844

APROÆREMA CROTOLARIELLA Busck.

Aproaerema crotolariella Busck, Proc. U. S. Nat. Mus., XXIII, 1900, p. 226, pl. 1, fig. 2; Dyar's List Amer. Lep., No. 5695, 1903.—DYAR, Proc. Ent. Soc. Washington, IV, p. 471, 1901.

This species is very near the following, *palpiliniella* Chambers, and has even the same coloration of the palpi as that species, but it is somewhat larger and may be readily recognized by the sprinkling of bluish-white scales on the forewings.

Food plant.—*Crotolaria pumila*.

Habitat.—Palm Beach, Florida.

Type.—No. 4933, U.S.N.M.

APROÆREMA PALPILINEELLA Chambers.

Gelechia palpilineella CHAMBERS, Conn. Quart. Journ. Sci., II, 1875, p. 252; Bull. U. S. Geol. Surv., IV, 1878, pp. 88, 145.—RILEY, Smith's List Lep. Bor. Am., No. 5442, 1891.

Aproaerema palpilineella Busck, Dyar's List Amer. Lep., No. 5696, 1903.

The supposed types (3) of this species in the Museum of Comparative Zoology in Cambridge are in poor condition, and represent at least two species in different genera, namely, the present and what I take to be *Aristotelia minimella* Chambers (p. 802). But the characteristic coloration of the labial palpi, mentioned by Chambers, which this species has in common with the preceding, shows that the name *palpiliniella* should be applied to the present species.

It has been bred in the insectary of the U. S. Department of Agriculture from red clover, on which it folds the leaves.

These bred specimens¹ were examined by Chambers in 1879, and in the Department notebook is Chambers' note on the specimens, in which he says:

Without specimens to compare it with I am unable to determine this species, but it is one of the group of small dark brown moths of the genus *Gelechia*, closely allied to *nigrella*, *palpiliniella*,² and *palpiliniella*, Chambers; possibly it may be one of these, if indeed these species are distinct, which may admit of doubt.³

I quote this note as one striking, but by no means unique, example of the difficulties which attend the determination of many of Chambers's species. With a practically valueless specific description, with absolutely no generic (sometimes not even family) characters given,

¹ Agr. Dept., No. 185.

² *Aristotelia absconditella* Walker, see p. 801.

³ Italicized by the writer.

and with most uncertain types mostly in miserable condition, representing two genera, the present worker can readily join in Chambers' own admission that there may indeed be doubt about the species.

The only way out of the difficulty is to select arbitrarily one species as Chambers' intended species, taking care that it does not disagree with his remarks, and that it is at least reasonable that it may represent his species.

Palpilineella is very commonly taken at light and is easily confounded with the equally common and similar *Aristotelia mininella* or with the following species. In U. S. National Museum are specimens from District of Columbia (Busck) and from New Jersey (Beutenmüller and Kearfott).

APROÆREMA NIGRELLA Chambers.

Gelechia nigrelli CHAMBERS, Cinn. Quart. Journ. Sci., II, pp. 250, 252; Bull. U. S. Geol. Surv., IV, 1878, p. 145.—RILEY, Smith's List Lep. Bor. Am., No. 5417, 1891.

Aproærema nigrella BUSCK, Dyar's List Amer. Lep., No. 5697, 1903.

Of this species there is one "type" received from Chambers in the Museum of Comparative Zoology, but it is in miserable condition (only one pair of wings) and does not agree with Chambers's description, having a narrow but very distinct white fascia at apical third. However, there is undoubtedly some variation in this point in these species, and I see no good reason not to regard it as truly representing the species, which is a somewhat larger form than the foregoing and without the palpal ornamentation common to the two preceding species.

APROÆREMA KEARFOTTELLA, new species.

Aproærema kearfottella BUSCK, Dyar's List Amer. Lep., No. 5698, 1903.

Antennæ black with narrow silvery white annulations. Labial palpi silvery white, terminal joint darker toward the tip, sprinkled with fuscous. Eyes red as in the *agrinaniella* group of the genus *Anacampsis*. Face silvery white, head and thorax iridescent dark bluish slate colored. Forewings purplish black, a conspicuous narrow curved white fascia on the middle of the wing, with the centrum for the curve at the base of the wing; no other markings on the wing proper. Cilia purplish black, with the tips of the middle part on the dorsal edge silvery white. Underside dark fuscous, with the white fascia plainly seen. Hindwings dark purplish fuscous, nearly black, especially toward the tip. Abdomen above deep bluish black, below silvery fuscous. All legs silvery white except the femora, which are purplish black; tarsi dusky.

Alar expanse.—12.5 mm.

Habitat. New Jersey.

Type.—No. 6370, U.S.N.M.

Cotype in collection of Mr. William D. Kearfott, to whom the National Museum is indebted for the type of this striking species.

It is in size and coloration nearest and very close to the *agrimoniella* group of the following genus, *Anacampsis*, and it is only referable to the present genus on account of the sinuate hindwings.

APROÆREMA NIGRATOMELLA Clemens.

Gelechia nigratomella CLEMENS, Proc. Ent. Soc. Phila., II, 1863, pp. 11, 121; III, 1864, p. 507; Stainton Ed. N. Am. Tin., 1872, pp. 217, 224, 260 —CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 145.—RILEY, Smith's List Lep. Bor. Am., No. 5416, 1891.

Gelechia apicilinella CLEMENS, Proc. Ent. Soc. Phila., II, 1863, p. 120; Stainton Ed. N. Am. Tin., 1872, pp. 223, 224.

Gelechia apicinuella CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 141.—RILEY, Smith's List Lep. Bor. Am., No. 5312, 1891.

Parasia apicistrigella CHAMBERS, Can. Ent., IV, 1872, p. 66.

Gelechia apicistrigella CHAMBERS, Can. Ent., IV, 1872, p. 175; Bull. U. S. Geol. Surv., IV, 1878, p. 141.

Anacampsis apicistrigella DIERZ, Smith's List Insects New Jersey, 1900, p. 475.

Aproærema nigratomella BUSCK, Dyar's List Amer. Lep., No. 5699, 1903.

One of the few of Clemens' types, which is still in existence in the Academy of Natural Sciences, is the type of the present species, which was found in good condition in May, 1900, during my visit there; it bears Clemens's No. 63 on the label, corresponding to a list in his handwriting with *nigratomella* var. for this specimen.

Clemens described two varieties of this species, one with shining white forewings, the other with ochreous white wings with costal edge at base pure white; there is some slight variation in the specimens I have seen, but all have at least an ochreous tint.

Chambers's type of *apicistrigella* in the Museum of Comparative Zoology in Cambridge is identical with Clemens' species, as the descriptions would indicate.

Riley made this latter a synonym of *Gelechia apicilinella* Clemens; the descriptions do not seem to support this synonymy and I doubt its correctness, but as Clemens' type is lost it must stand for the present on Riley's authority.

This species is very close to the following, *coccinusella* Chambers, having the identical ornamentation, but easily distinguished by the light groundcolor, while *coccinusella* has the groundcolor of the forewing dark. Chambers says in his description of *coccinusella*:¹

It may prove to be identical with *Gelechia apicistrigella* Chambers, but I think not.

Lord Walsingham evidently was in doubt whether the two were merely varieties of the same species or distinct species, as is proved

¹ U. S. Geological Survey Bull., III, p. 127.

by two specimens in the U. S. National Museum which are labeled in his handwriting, respectively, "*Concinusella Cham? = apicistrigella, dark variety*," and "*apicistrigella Cham? = Concinusella, light variety*," but inasmuch as there seems to be no gradual transition between the two different forms, they must be regarded as distinct species, as I feel certain they are, until disproven by the breeding of both forms from the same kind of larva.

I have examined very many specimens of this common form, among which specimens named by Lord Walsingham in Professor Fernald's collection and bearing his blue labels no. 115, 1094, 1116, and 1033 corresponding with the identification in his notebook as *apicistrigella*.

Habitat.—Eastern United States, Kentucky, Colorado.

APROÆREMA CONCINUSELLA Chambers.

Gelechia concinusella CHAMBERS, Cinn. Quart. Journ. Sc., II, 1875, p. 253; Bull. U. S. Geol. Surv., IV, 1878, p. 142.—RILEY, Smith's List Lep. Bor. Am., No. 5340, 1891.

Gelechia concinnisella CHAMBERS, Bull. U. S. Geol. Surv., III, 1877, p. 127.

Aproaerema concinusella BUSCK, Dyar's List Amer. Lep., No. 5700, 1903.

Type No. 448, in the U. S. National Museum, received from Chambers, as this species agrees well with description and is identical with his types in the Cambridge Museum.

This species has a notable color resemblance to *Epithectis* (*Parusia*?) *subsimella* Clemens.

Habitat.—Texas, Colorado.

ANACAMPSIS Curtis.

Plate XXXI, fig. 28.

Type, *Tinea*, i. e. *Tinea porulella* Clerck.

Anacamptis CURTIS, Brit. Ent., 1827, expl. pl. clxxxix.

Tachypitilla HEINEMANN (Meyrick, Staudinger and Rebel), Schmetterlinge Deutschlands u. d. Schweiz, II, 1870, p. 321.

Labial palpi very long curved, second joint thickened with smoothly appressed scales, sometimes roughened above in the middle; terminal joint longer than second, slender pointed. Abdomen somewhat flattened. Forewings elongate, apex blunt, termen very oblique; 12 veins, 7 and 8 stalked, rest separate. Hindwings as broad or broader than forewings, trapezoidal termen not sinuate, 8 veins, 3 and 4 connate, 5 parallel, 6 and 7 connate.

I have recognized the following American species as belonging to this genus:

Basal half of forewings without any markings	1
Basal half of forewings more or less mottled	8
1. Forewings without white markings	2
Forewings with white markings	3
2. Color ochraceous	<i>fullonella</i> , p. 849
Color black	<i>lupinella</i> part, p. 850

3. Forewings with transverse fascia	4
Forewings without transverse fascia	6
4. Forewings with three apical longitudinal white dashes	<i>tristrigella</i> , p. 851
Forewings without such dashes	5
5. Color markedly darker outside the fascia	<i>agrimoniella</i> , p. 850
Color dark on both sides of the fascia	<i>lupinella</i> , part., p. 850
6. Forewings with one costal white streak	7
Forewings with two costal white streaks	<i>levpedella</i> , p. 851
7. Color light ochreous brown	<i>pallodoriella</i> , p. 848
Color black	<i>lupinella</i> , part., p. 850
8. With large semicircular dark dorsal spot	<i>cycella</i> , p. 848
Without such spot	9
9. With dark costal spot	<i>lagunculariella</i> , p. 848
Without such spot	10
10. With face whitish	<i>argyrothamniella</i> , p. 847
Face not white	11
11. With sharp white markings	<i>nireoputella</i> , p. 847
Markings indistinct	12
12. Groundcolor ash-gray	<i>crucetifasciella</i> , p. 846
Groundcolor brownish	13
13. Alar expanse more than 20 mm.	<i>innocella</i> , p. 845
Alar expanse less than 20 mm.	<i>rhoifruetella</i> , p. 845

ANACAMPSIS INNOCUELLA Zeller.

Gelechia (Tachypitilia) innocella ZELLER, Verh. k. k. zool.-bot. Gesell. Wien, XXIII, 1873, p. 240.

Gelechia innocella CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 144.—RILEY, Smith's List Lep. Bor. Am., No. 5389, 1891.

Anacampsis innocella BUSCK, Dyar's List Amer. Lep., No. 5701, 1903.

This species and still more the following are, as Zeller remarked, very similar to the European *Anacampsis populella* Clerck, but both have the wings more blunt.

I have examined the types of the present species in Cambridge.

In the National Museum is a series, identical with the types, bred from leaves of cottonwood received from Wyoming; also a large series bred from cottonwood in Colorado by Dr. Dyar.

The larva rolls the leaves in the same fashion as does the European *populella*.

Zeller's types are from Texas.

ANACAMPSIS RHOIFRUCTELLA Clemens.

Gelechia rhoifruetella CLEMENS, Proc. Acad. Nat. Hist. Phila., 1880, p. 163; Proc. Ent. Soc. Phila., II, 1863, p. 121; Stainton Ed. N. Am. Tin., 1872, pp. 40, 114, 225.

Gelechia rhoifruetella CHAMBERS, Can. Ent., III, 1872, p. 68; Bull. U. S. Geol. Surv., IV, 1878, p. 146.—ZELLER, Verh. k. k. zool.-bot. Gesell. Wien, XXIII, 1873, p. 252.—COQUILLETT, Papilio, III, 1883, p. 99.—RILEY, Smith's List Lep. Bor. Am., No. 5406, 1891.

Tachypitilia rhoifruetella DIERZ, Smith's List Ins. N. Jersey, p. 474, 1900.

Gelechia (Tachypitilia) cansonella ZELLER, Verh. k. k. zool.-bot. Gesell. Wien., XXIII, 1873, p. 251.—WALSINGHAM, Trans. Amer. Ent. Soc. Phila., X, 1882, p. 183.

- Gelechia consonella* CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 142.—RILEY, Smith's List Lep. Bor. Am., No. 5338.
- Gelechia quadrimaculella* CHAMBERS, Can. Ent., VI, 1874, p. 237; Bull. U. S. Geol. Surv., IV, 1878, p. 146.—RILEY, Smith's List Lep. Bor. Am., No. 5459, 1891.
- Gelechia ochreocostella*, CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, pp. 91, 145.
- Anacampsis rhoifrutella* BUSCK, Dyar's List Amer. Lep., No. 5702, 1903.
- Not *Gelechia quadrimaculella* CHAMBERS, Cinn. Quart. Journ. Sci., II, 1875, p. 290; Bull. U. S. Geol. Surv., III, 1877, p. 128.

Lord Walsingham has established the synonymy *rhoifrutella*=*ochreocostella*, and suggested that *consonella* Zeller was also this species. I have seen the types in the Museum of Comparative Zoology of *quadrimaculella* Chambers, *consonella* Zeller, and *ochreocostella* Chambers, and in U. S. National Museum there is a type (No. 461) of *ochreocostella* and specimens named by Walsingham, *rhoifrutella*. All of these specimens are identical and confirm Lord Walsingham's synonymy, adding that of *quadrimaculella* Chambers, as was to be expected from the description of the species.

Both of Chambers' species as well as Zeller's type came from Texas. Clemens presumably reared his in Pennsylvania.

The other species named by Chambers *quadrimaculella* and afterwards renamed *pruinominella*, is evidently an entirely different insect, which I have recognized as a species of *Gelechia*, under which genus it is treated (p. 875).

ANACAMPISIS CRESCENTIFASCIELLA Chambers.

- Gelechia crescentifasciella* CHAMBERS, Can. Ent., VI, 1874, p. 237; Cinn. Quart. Journ. Sci., II, 1875, p. 255; Bull. U. S. Geol. Surv., IV, 1878, pp. 90, 142.
- Anacampsis crescentifasciella* BUSCK, Dyar's List Amer. Lep., No. 5703, 1903.
- Not *Gelechia crescentifasciella* WALSHINGHAM, Trans. Amer. Ent. Soc. Phila., X, 1882, p. 179.

Lord Walsingham made this species a synonym of *Gelechia conclusella* Walker, but this was clearly caused by a mistake. The supposed type of *crescentifasciella* from Mr. Goodell's collection, on the strength of which Walsingham made the synonymy, is now in Professor Fernald's collection, and he has explained that by mistake this specimen was represented as the type, but that it really was not authentic. It is a specimen of *conclusella* Walker. In Lord Walsingham's notebook¹ is written under the number corresponding to his blue label on this specimen "1034, *G. conclusella* Walker=*G. crescentifasciella*, Chambers's type," but the word "type" was afterwards crossed over.

In the U. S. National Museum there is a type (No. 446) received from Chambers with his handwriting *crescentifasciella*. This type is the

¹ See preface, p. 768.

same as eight specimens in Cambridge Museum, also received from Chambers, and furnished with his label. These specimens agree with Chambers' description, and undoubtedly represent the present species, which is very different from *conclusella* Walker. One of these specimens, originally from the Salem collection, bears Walsingham's blue label no. 980, and is labeled in his handwriting "*Gelechia crescentifasciella* Chambers, but quite distinct from his type."¹

Crescentifasciella does resemble, as remarked by Chambers, *Gelechia quadrinmaculella*,² "but is smaller and of a more ashen hue."

No other specimen than the types mentioned are known to me.

The supposed "type" in Professor Fernald's collection, received from Chambers through Miss Murtfeldt, is an *Elachistid*, wrongly identified.

ANACAMPSIS NIVEOPULVELLA Chambers.

Gelechia niveopulvella CHAMBERS, Can. Ent., VII, 1875, p. 210; Bull. U. S. Geol. Surv., IV, p. 1878.—RILEY, Smith's List Lep. Bor. Am., No. 5419, 1891.

Anacamopsis niveopulvella, BUSCK, Dyar's List Amer. Lep., No. 5704, 1903.

The unique type of this species was obtained in good condition from the Belanger collection, Laval University, Quebec, where it has been since returned by Chambers in 1875. It bears Chambers' label, agrees well with his description, and is undoubtedly authentic.

It proves the species to be a large *Anacamopsis* of the size of *innocuella* Zeller. It has the same general pattern of ornamentation as this species, but much more pronounced in black and white. In Europe are known very similar corresponding varieties of *Anacamopsis populella* Clerck, and *niveopulvella* may ultimately prove to be such a variety of *innocuella*; but as it is easily recognized and markedly different from the common form of *innocuella*, and as no intermediate forms are known as yet, it must be retained as a good species until proof of the identity with *innocuella* is given by breeding.

In the U. S. National Museum are other specimens identical with the type from Vancouvers Island, and the northern latitude may be cause of the variety. Chambers' type came from Canada.

ANACAMPSIS ARGYROTHAMNIELLA Busck.

Anacamopsis argyrothamniella BUSCK, Proc. U. S. Nat. Mus., XXIII, 1900, p. 231; Dyar's List Amer. Lep., No. 5705, 1903.—DYAR, Proc. Ent. Soc. Washington, IV, 1901, p. 474.

Type.—No. 4938, U.S.N.M.

Food plant.—*Argyrothamnia blodgettii*.

Habitat.—Palm Beach, Florida.

¹ The supposed type from Goodell's collection.

² *Anacamopsis rhoifrutella* Clemens, p. 845.

ANACAMPSIS LAGUNCULARIELLA Busck.

Anacamopsis lagunculariella Busck, Proc. U. S. Nat. Mus., XXIII, 1900, p. 230, pl. I, fig. 6; Dyar's List Amer. Lep., No. 5706, 1903.—DYAR, Proc. Ent. Soc. Washington, IV, 1901, p. 474.

Type.—No. 4937, U.S.N.M.

Food plant.—*Laguncularia racemosa*.

Habitat.—Palm Beach, Florida.

ANACAMPSIS CYCLELLA, new species.

Anacamopsis cyclella Busck, Dyar's List Amer. Lep., No. 5707, 1903.

Antennæ whitish yellow, annulated with black. Labial palpi whitish yellow, terminal joint toward tip fuscous. Face, head, and thorax whitish yellow. Ground color of forewings whitish yellow shaded with darker fawn. On the middle of the dorsal edge is a large, semi-circular, dark olive-brown spot, reaching to the middle of the wing and edged with white. The apical half of costal edge is of this same dark brown color, interrupted by four oblique white streaks, the first near the middle of the wing, the second at beginning of costal cilia, both directed outward. The two last streaks are smaller nearer apex and directed inward. The second costal streak is faintly continued in a thin, outwardly pointed, V-shaped fascia, at the tip of which is a longitudinal black dash, edged with white scales. Above and below this dash, outside of the faint white fascia, the wing is finely checkered with black and white scales. On the middle of the wing at the end of the cell is a small, dark brown, oblong spot. Upper half of the cilia is dark reddish brown, with base white; through this white base runs a heavy black line parallel with the edge of the wing. Lower half of cilia yellowish white. When the moth is at rest the two dorsal spots on the wings unite to form a conspicuous dark circle, edged with white. Hindwing dark olive brown, lighter and silvery toward the base; cilia golden. Abdomen and underside of thorax silvery yellow. Legs yellowish white annulated with brown; tarsi dark brown tipped with white. Alar expanse, 14 to 14.5 mm.

Habitat.—Arizona.

Type.—No. 6371, U.S.N.M.

Described from three well-preserved specimens—two collected by Mr. E. A. Schwarz, at Santa Rita Mountains, in May and June; the third collected by Mr. H. S. Barber, in July, at Williams, Arizona.

ANACAMPSIS PALTODORIELLA, new species.

Anacamopsis paltodoriella Busck, Dyar's List Amer. Lep., No. 5708, 1903.

Antennæ silvery white with a heavy longitudinal dark brown line running from base to tip. Labial palpi, second joint yellowish white, terminal joint silvery white with a slender longitudinal black line in

front from base to apex. Face creamy white; head and thorax light drab colored. Forewings drab colored, lightest nearly white along the costa, gradually darker toward dorsal edge.

In the middle of the cell is a small indistinct blackish dot, a similar one nearer base on the fold and a third at the end of the cell. At apical fourth is an oblique narrow white streak directed outward and nearly meeting a similar but curved dorsal streak directed upward and outward. Both streaks are slightly edged with black anteriorly. The area between the dorsal streak and the edge of the wing is white, mottled finely with black, each scale being tipped with black. Apical cilia dark brown with base whitish and containing a heavy blackish perpendicular line; dorsal cilia yellowish white with the apical dark line continued fainter and interrupted along the edge of the wing. Hindwings dark purplish fuscous, cilia a shade lighter and with a narrow whitish line at base along the edge of the wing. Abdomen dark purplish except first two joints above which are light velvety yellow, anal tuft yellowish.

Fore and middle legs and underside of thorax deep dull brown, nearly black; tarsal joints tipped with yellow; hindlegs on the outside dark brown mottled with yellow, the inside and tuft on tibial yellow, tarsi banded with yellow.

Alar expanse.—3 mm.

Habitat.—Mesilla Park, New Mexico.

Type.—No. 6372, U.S.N.M.

A beautiful species, near the foregoing, *cycellu*, collected by Prof. T. D. A. Cockerell.

The wing pattern strongly reminds one of the *striatellu* group of the genus *Paltodora*.

ANACAMPSIS FULLONELLA Zeller.

Gelechia (*Ceratophora*?) *fullonella* ZELLER, Verh. k. k. zool.-bot. gesell. Wien, XXIII, 1873, p. 276.

Gelechia fullonella CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 143.—RILEY, Smith's List Lep. Bor. Am., No. 5366, 1891.

Gelechia rufusella CHAMBERS, Can. Ent., VI, 1874, p. 240; Bull. U. S. Geol. Surv., IV, 1878, p. 1474.—RILEY, Smith's List Lep. Bor. Am., No. 5472, 1891.

Gelechia (*Trichotaphe*) *refusella* WALSHINGHAM, Trans. Am. Ent. Soc. Phila., X, 1882, p. 184.

Gelechia subrubrella CHAMBERS, Can. Ent., VI, 1874, p. 240; Cinn. Quart. Journ. Sci., II, 1875, p. 254; Bull. U. S. Geol. Surv., IV, p. 147, 1878.—RILEY, Smith's List Lep. Bor. Am., No. 5486, 1891.

Menesta rubescens WALSHINGHAM, Proc. Zool. Soc. Lond., p. 319, 1881, pl. xxxvi, fig. 9.

Anacamptis fullonella BUSCK, Dyar's List Amer. Lep., No. 5709, 1903.

The types of *fullonella* are in the possession of Lord Walsingham, to whom I am indebted for the information (in letter of May 10, 1901) that it is the same as Chambers' *rufusella*.

Of this latter species I have examined type no. 463 in the U. S. National Museum, and Chambers' types in Cambridge as well as specimens in the National Museum and in the Philadelphia Academy of Natural Sciences, determined by Lord Walsingham; they are all identical and undoubtedly represent Chambers' *rufusella*.

The supposed type of this species in Professor Fernald's collection is a very similar species of *Trichotaphe*, which I feel confident represents Chambers' *Gelechia bidiscomaculella* (p. 914).

In the U. S. National Museum are undoubted specimens of *rufusella* which, in my opinion, represent Chambers' *subrubrarella*, which species Chambers himself, in his original description, suggested was only a variety of *rufusella*. As all authentic specimens of *subrubrarella* are lost, and as *rufusella* is a somewhat variable species, I place the two as synonyms without much hesitation, thus disposing of an otherwise empty name.

Lord Walsingham suggested that this species is a *Trichotaphe*, but the separate veins 2 and 3 in forewings and the very long terminal joint of the labial palpi place it in the present genus.

The general habitus of the species is truly very similar to *Trichotaphe*, and it is one proof of the close relationship of the two genera.

All the specimens I have seen are from Texas.

ANACAMPSIS LUPINELLA Busck.

Anacamptis lupinella BUSCK, Can. Ent., XXXIII, 1901, p. 14; Dyar's List Amer. Lep., No. 5710, 1903.

Type.—No. 5351. U.S.N.M.

Food plant.—*Lupinus perennis*.

Habitat.—Canada.

Since describing this species I have had the pleasure of breeding it myself from larva, kindly sent me by my friend, Mr. Arthur Gibson, Ottawa, Canada, thus obtaining more material of this interesting species.

ANACAMPSIS AGRIMONIELLA Clemens.

Gelechia agrimoniella CLEMENS, Proc. Acad. Nat. Sci. Phila., 1860, pp. 162, 434; Proc. Ent. Soc. Phila., II, 1863, p. 120; Stainton Ed. Tin. N. Am., 1872, pp. 40, 112, 224.—CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 141.—RILEY, Smith's List Lep. Bor. Am., No. 5301, 1891.

Gelechia (Anacamptis) agrimoniella ZELLER, Verh. k. k. zool.-bot. Gesell. Wien, XXIII, 1873, p. 275

Tuchiptilia agrimoniella DIETZ, Smith's List Ins. N. Jersey, 1900, p. 474.

Gelechia aduncella ZELLER, Verh. k. k. zool.-bot. Gesell. Wien, XVIII, 1868, p. 614.

Gelechia adersella RILEY, Smith's List Lep. Bor. Am., No. 5299, 1891.

Anacamptis agrimoniella BUSCK, Can. Ent., XXXIII, 1901, p. 15; Dyar's List Amer. Lep., No. 5711, 1903.

This well-known and thoroughly described species has been recorded from Pennsylvania, District of Columbia, and Georgia. In the

National Museum are also bred and collected specimens from Virginia, New York, and Kansas.

Food plant.—*Agrimonia*.

This and the following species have a marked resemblance to the *anthyllidella* group of the genus *Aproærema*, which has caused former workers (Zeller, Stainton, and Walsingham) to place it in that genus in spite of the differing wing form and venation, but they clearly belong to the present genus, and only indicate the relationship of the two genera.

ANACAMPSIS TRISTRIGELLA Walsingham.

Gelechia (*Anacampsis*) *tristrigella* WALSINGHAM, Trans. Amer. Ent. Soc. Phila., X, 1882, p. 181.—COQUILLETT, Papilio, III, 1883, p. 91.

Gelechia tristrigella COMSTOCK, Rep. U. S. Ent. Comm., V, 1890, p. 639.—RILEY, Smith's List Lep. Bor. Am., No. 5502, 1891.

Anacampsis tristrigella BUSCK, Can. Ent., XXXIII, 1901, p. 15; Dyar's List Amer. Lep., No. 5712, 1903.

Of this easily recognized species I have identified a specimen from Kansas in U. S. National Museum, which identification I subsequently had opportunity to verify by comparison with the type in Professor Fernald's collection.

Food plant.—*Corylus americana* (Coquillett).

ANACAMPSIS LEVIPEDELLA Clemens.

Strobisia levipedella CLEMENS, Proc. Ent. Soc. Phila., II, 1863, p. 4; Stainton Ed. Tin. N. Am., 1872, p. 207.—CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 162.—FREY, Stett. Ent. Zeit., XXXIX, 1878, p. 251.—RILEY, Smith's List Lep. Bor. Am., No. 5584, 1891.

Anacampsis levipedella BUSCK, Can. Ent., XXXIII, 1901, p. 15; Dyar's List Amer. Lep., No. 5713, 1903.

The type of this species is lost, but no doubt whatever exists about the identity of this common, striking, well-described species.

I have examined specimens determined by Chambers in the Museum of Comparative Zoology, in Cambridge, and specimens named by Lord Walsingham in the National Museum.

While this species has a certain general resemblance to the genus *Strobisia*, its structural characters place it in *Anacampsis*, in which it finds a near relative in the preceding species, *tristrigella* Walsingham.

Professor Frey's excellent description of the characteristic underside of the wings is an important addition, and emphasizes the relationship with this group.

The species is rather common around Washington City.

GELECHIA Hübner.

Plate XXXI, fig. 29.

Gelechia HÜBNER, Verz. bek. Schmett., 1816, p. 415.

Cirrho CHAMBERS, Can. Ent., IV, 1872, p. 146.

Oeneis CHAMBERS, Cinn. Quart. Journ. Sci., II, 1875, p. 255.

Pseudochelaria DIETZ, Ent. News, XI, 1900, p. 252, pl. 1, fig. 3.

Labial palpi long curved, second joint more or less thickened beneath, with rough scales, sometimes with large developed brush, sometimes furrowed; terminal joint nearly as long or longer than second joint, smooth pointed. Forewings elongate pointed, with 12 veins, 7 and 8 stalked, rest separate. Hindwings nearly as broad or broader than forewings; apex pointed, termen more or less sinuate; 8 veins, 3 and 4 connate or short stalked, 5 approximate to 4, 6 and 7 approximate, connate or stalked.

Two species, namely, *conclusella* Walker and *busquella* Chambers, which have been included in the present genus, differ from this synopsis in having veins 3 and 4 in the forewings stalked, but I do not believe generic separation would be justified on that ground, as there is a tendency in allied species to have these veins approximate, or even connate (*Gelechia abdominella* Busck), and as they in all other particulars agree with the genus.

Chambers' genus *Cirrho* does not in any way differ from *Gelechia*, as examination of the type has proven.

Oeseis Chambers has very strongly developed and somewhat specialized brush on second joint of labial palpi, approaching that of *Ypsolophus*; but otherwise in general habitus, wing form, and venation it agrees well with *Gelechia* as here defined, and I do not believe it can be retained as a natural separate genus in view of the many intermediate forms found between it and normal *Gelechia* species.

Pseudochelaria Dietz has justly been made a synonym of *Gelechia* by Lord Walsingham and J. Hartley Durrant.¹

From the examination of the supposed type of Lord Walsingham's genus of that name, *pennsylvanica* Dietz (Walsingham manuscript), which is now in Dr. Dietz's possession, I am unable to see why a new genus should be erected for it as Lord Walsingham suggests, and have, consequently, included that species also in the present genus. Some mistake has likely been made.

The genus *Catastega* Clemens, which was erected solely on larval food habits, I had at a time suspected to be synonymous with *Gelechia*, and it is so placed in Dr. Dyar's List of American Lepidoptera. I had reached this conclusion by breeding *Gelechia serotinella* Busck, which has the identical and very peculiar life mode described by Clemens for the genus *Catastega*, and I surmised that Clemens' species, when bred, might turn out to belong to the same group.

Since then, however, Dr. Dyar has succeeded in breeding what must be regarded as type of Clemens' genus, the oak feeding *timidella*, and it turns out to be a Tortricid (not yet determined,² because of rubbed condition of the specimens).

¹ Ent. Mo. Mag. 1902, p. 28.

² For this reason *Catastega*, with its three species, was retained in Dr. Dyar's List of American Lepidoptera under *Gelechia*, as it was not known where else to place them.

This and the two other species, which were placed heading the list of unrecognized species of *Gelechia* have thus no place there, and need not give more trouble in this group.

Under *Gelechia* it has been necessary to place not only such species which have been recognized by the writer as belonging to the genus, but also all those species which have been described as or referred to *Gelechia*, but which at present are unknown and therefore of uncertain generic position; in fact, some of these evidently do not belong to *Gelechia*, but as their true genus can not be ascertained at present they must temporarily stand under *Gelechia* as described.

All these unplaced species I have put in section B., which then merely indicates that such species are retained in the genus only on the authority of the original description. These species must of course be reckoned with when a new species is to be described in any *Gelechiid* genus. It is a tedious work, always more or less uncertain, to go over all these descriptions before one is reasonably sure not to make a synonym.

To insure myself as far as possible against this I have made for my own use a synoptic table of all these uncertain species, using such striking characters as can be gleaned from the descriptions, but even with this many descriptions must be gone over.

All species placed in section A can be relied upon as conforming with the definition of the genus *Gelechia* in all particulars, except when otherwise expressly remarked upon.

The following synoptic table includes only these recognized species:

Ground color black or very dark uniform brown	1
Ground color not black or dark uniform brown	21
1. With head canary yellow	<i>aristella</i> , p. 866
Head not yellow	2
2. Forewings with white or whitish markings only	3
Forewing with dorsal edge rust red	<i>busquella</i> , p. 864
3. With head pure white	4
With head more or less mottled	-14
4. With basal half of dorsal edge white	5
Dorsal edge not white	9
5. Entire dorsal edge white	<i>pauella</i> , p. 865
Entire dorsal edge not white	6
6. With oblique white fascia at apical fourth	<i>unifasciella</i> , p. 865
Without such fascia	7
7. With abdomen and legs salmon colored	<i>abdominella</i> , p. 863
Abdomen not salmon colored	8
8. With white streak on basal half of costa	<i>sistrella</i> , p. 862
Without such streak	<i>dentella</i> , p. 862
9. With thorax white	10
Thorax not white	12
10. Forewings with white fascia and costal spots	<i>albiforella</i> , p. 861
Forewings without such fascia and spots	11
11. Forewings with faint ochreous white dots on disk	<i>minimaculella</i> , p. 867
Forewings without such dots	<i>thoracealbella</i> , p. 867

12. Forewings with white markings sharply defined.....	13
White markings diffused.....	<i>continuaella</i> , p. 859
13. Forewings with white spot on fold.....	<i>quinella</i> , p. 856
Forewings without white spot on fold.....	<i>cerecrisella</i> , p. 855
14. With dorsal edge from base to cilia white.....	<i>packardella</i> , p. 866
Dorsal edge not white.....	15
15. With white oblique costal streak at basal third.....	16
Without such streak.....	18
16. With complete white fascia at apical third.....	<i>lugubrella</i> , p. 861
Without such fascia.....	17
17. Face and second joint of labial palpi white.....	<i>coloradensis</i> , p. 857
Face and second joint of labial palpi dark.....	<i>arizonella</i> , p. 856
18. With angulate white fascia at apical third.....	19
Without such fascia.....	20
19. Basal part of forewings lighter, sprinkled with white.....	<i>trophella</i> , p. 860
Basal part of forewings not lighter than rest of wing.....	<i>bimaculella</i> , p. 859
20. Second joint of labial palpi light ochreous white.....	<i>trialbamaculella</i> , p. 858
Second joint of labial palpi dark.....	<i>confusella</i> , p. 859
21. Forewings brick red.....	<i>panella</i> , p. 889
Forewings not brick red.....	22
22. Apical edge of forewing and cilia rose.....	<i>ribesella</i> , p. 860
Forewings not rose.....	23
23. Ground color pure white.....	<i>fuscoternella</i> , p. 890
Ground color not pure white.....	24
24. Apical third of forewings white.....	<i>abella</i> , p. 889
Apical third of forewings not white.....	25
25. Forewings with ocellate discal spots.....	26
Forewings without ocellate spots.....	28
26. Ground color dark purplish brown.....	<i>discoocellella</i> , p. 874
Ground color not brown.....	27
27. Ground color whitish gray.....	<i>liamulella</i> , p. 873
Ground color ochreous white.....	<i>obscuroocellella</i> , p. 878
28. Forewings without any distinct markings.....	29
Forewings distinctly marked.....	31
29. Forewings dark steel gray.....	<i>anarsiella</i> , p. 874
Forewings not dark steel gray.....	30
30. Ground color light ochreous.....	<i>rileyella</i> , p. 887
Ground color grayish white.....	<i>obscuronuffusella</i> , p. 888
31. Dorsal edge conspicuously lighter than costal edge.....	32
Dorsal edge not lighter than rest of wing.....	34
32. Base of forewings light ochreous.....	<i>mediofuscella</i> , p. 885
Base of forewings not light.....	33
33. Entire thorax light ochreous.....	<i>hibiscella</i> , p. 869
Only central part of thorax ochreous.....	<i>ochreostrigella</i> , p. 869
34. Second joint of labial palpi deep black.....	35
Second joint of labial palpi not black.....	36
35. Forewings with indistinct white markings.....	<i>albisparsella</i> , p. 871
Forewings without white markings.....	<i>unctulella</i> , p. 873
36. Forewings without any transverse markings.....	37
Forewings with costal spots or other transverse markings.....	41
37. Forewings uniformly longitudinal streaked without other markings.....	38
Forewings with other markings.....	39
38. Forewings brownish.....	<i>ochreosuffusella</i> , p. 863
Forewings gray.....	<i>striatella</i> , p. 863

39. With heavy black longitudinal streak on fold.....	<i>variabilis</i> , p. 871
Without such streak.....	40
40. Forewings strongly mottled with dark fuscous spots.....	<i>nudimella</i> , p. 888
Forewings without such spots.....	<i>petasitis</i> , p. 888
41. Dorsal base of forewing darker than general color of wing.....	42
Base of dorsum not darker than general color of wing.....	44
42. With angulated whitish fascia at apical third.....	43
Without such fascia.....	<i>cockerelli</i> , p. 871
43. With oblique light band at basal third.....	<i>walsinghami</i> , p. 885
Without such band.....	<i>peninsularum</i> , p. 885
44. With white or whitish markings at apical third.....	45
Without white markings at apical third.....	60
45. With longitudinal deep black line on fold.....	<i>trilineella</i> , p. 873
Without such line.....	46
46. With complete fascia at apical third.....	47
Fascia more or less interrupted or absent.....	57
47. With head unmottled ochreous.....	<i>monumentella</i> , p. 888
Head more or less mottled.....	48
48. Forewings with vein 3 and 4 stalked.....	<i>conclusella</i> , p. 887
Forewings with veins 3 and 4 separate.....	49
49. Forewings with longitudinal black line before apex.....	<i>aequalis</i> , p. 884
Without such line.....	50
50. With large black discal spot reaching up to costal edge.....	<i>occidentella</i> , p. 884
Without such spot.....	51
51. Fascia strongly outwardly angulated.....	52
Fascia nearly straight.....	55
52. Face white.....	53
Face not white.....	54
53. Tuft on second joint of labial palpi large, much longer at base than at apex,	
.....	<i>versutella</i> , p. 878
Tuft on second joint short and even in its entire length.....	<i>lynceella</i> , p. 879
54. Central part of underside of abdomen pure ochreous white.....	<i>nigrimaculella</i> , p. 880
Underside of abdomen dark mottled.....	<i>hymenimaculella</i> , p. 881
55. With dark costal spot at basal third.....	<i>bicostomaculella</i> , p. 879
Without such spot.....	56
56. Terminal joint of labial palpi with white annulation before tip.....	<i>tephriassella</i> , p. 886
Terminal joint of labial palpi without annulation.....	<i>dyariella</i> , p. 877
57. Basal half of costa whitish.....	<i>pseudocariella</i> , p. 881
Basal half of costa not whitish.....	58
58. First abdominal segments velvety ochreous above.....	<i>serotinella</i> , p. 882
First abdominal segments not velvety ochreous above.....	59
59. Forewings with raised scales.....	<i>maculimarginella</i> , p. 881
Forewings without raised scales.....	<i>vernella</i> , p. 884
60. With base of costa black.....	<i>lindenella</i> , p. 876
Base of costa not black.....	61
61. With horny frontal prominence.....	<i>barnesiella</i> , p. 875
Without such.....	<i>pravinominella</i> , p. 875

A.—Recognized Species.

GELECHIA CERCERISELLA Chambers.

Depressaria cercerisella CHAMBERS, Can. Ent., IV, 1872, pp. 108, 129, 147, 148.

Gelechia cercerisella CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, pp. 110, 142.—

WALSINGHAM, Trans. Am. Ent. Soc. Phila., 1882, p. 177.—RILEY, Smith's

List Lep. Bor. Am., No. 5334.—BUSCK, Dyar's List Amer. Lep., No. 5714, 1903.

Gelechia olympiadella ZELLER, Verh. k. k. zool.-bot. Gesell. Wien, XXIII, 1873, p. 259, pl. III, fig. 15.—CHAMBERS, Can. Ent., IX, 1877, p. 24; Bull. U. S. Geol. Surv., IV, 1878, p. 145.—RILEY, Smith's List Lep. Bor. Am., No. 5433.

Not *Gelechia cercerisella* CHAMBERS, Can. Ent., VI, 1874, pp. 230-231; Can. Ent., IX, 1877, p. 23.—WALSINGHAM, Trans. Am. Ent. Soc. Phila., 1882, p. 179.

Chambers found what he supposed to be a variety of the species in Texas with an additional white spot on the fold and consequently made *Gelechia quinella* Zeller, which is this supposed variety a synonym of the present species. This "variety" is truly *quinella* Zeller, but is a quite distinct species, while Zeller's *olympiadella*, as the description, figure, and types in Cambridge Museum show, is the same as Chambers' *Cercis* feeding species. Zeller points out well the differences between the two species.

The present species is one of the commonest *Gelechiids* in the vicinity of Washington, and its pretty larva, well described by Chambers, can be found all summer spinning up the leaves of redbud. There are at least two generations in this locality. The imagoes of one brood issue about September 1, and the following brood overwinters as pupa and comes forth as imago in early May.

In U. S. National Museum are authentic specimens, received and labeled by Chambers, besides large bred series from District of Columbia, and captured specimens from Kansas and Texas.

GELECHIA QUINELLA Zeller.

Gelechia quinella ZELLER, Verh. k. k. zool.-bot. Gesell. Wien., XXIII, 1873, p. 260, pl. III, fig. 14.—CHAMBERS, Can. Ent., IX, 1877, p. 23.—BUSCK, Dyar's List Amer. Lep., No. 5715, 1903.

Gelechia cercerisella var. CHAMBERS, Can. Ent., VI, 1874, p. 231; IX, 1877, p. 23.—WALSINGHAM, Trans. Am. Ent. Soc. Phila., 1882, p. 177.

This species must, according to the explanation given under the previous species, stand as a good species, distinct from *cercerisella* Chambers=*olympiadella* Zeller.

I have examined, besides Zeller's types in the Cambridge Museum, the specimens there, originally belonging to Salem Academy of Natural History, which Lord Walsingham had before him in 1882 with his blue labels, nos. 976 and 989.

Authentic specimens of Chambers' supposed variety of *cercerisella* are found in Cambridge Museum and in U. S. National Museum, where are also several other specimens, all like the type and Chambers' specimens from Texas.

GELECHIA ARIZONELLA, new species.

Gelechia arizonella BUSCK, Dyar's List Amer. Lep., No. 5716, 1903.

Antennae black; labial palpi with dense slightly furrowed brush, black; the inside of the second joint and the middle of the terminal

joint with sparse whitish scales intermixed. Face, head, and thorax whitish, but heavily overlaid with dark fuscous scales; top of head and middle of thorax lighter than face and shoulders. Forewings deep bronzy black with four white markings, namely, one large outwardly oblique white costal streak near base, the lower tip of which crosses the fold; one nearly elliptical white spot on the middle of the wing; one triangular white costal spot at the beginning of the cilia, and opposite this a smaller dorsal white spot.

The spots are identical with those found in the two preceding species, *cercerisella* and *quinella*, except that the second costal spot in the former and the two middle spots of the latter have been replaced by the single central spot in *arizonella*.

Hindwings as broad as forewings; light silvery fuscous, darker along costa and toward the tip. Cilia a shade lighter. Abdomen light fuscous with a metallic purple sheen; each joint is fringed posteriorly with whitish scales, and the two first joints are velvety yellowish above.

Legs dark fuscous; tarsal joints narrowly tipped with whitish.

Alar expanse.—13 to 15 mm.

Habitat.—Arizona.

Type.—No. 6373, U.S.N.M.

Collected by Mr. E. A. Schwarz in Santa Rita Mountains, Arizona, in May.

Very near the foregoing species and the following, but at once distinguished by its dark head, its different wing spots, and its unbarred legs.

GELECHIA COLORADENSIS, new species.

Gelechia coloradensis Busck, Dyar's List Amer. Lep., No. 5717, 1903.

Antennæ black; labial palpi with well-developed brush; second joint white, slightly sprinkled with dark scales above, terminal joint black with white tip. Face white; head and thorax uniform dark purplish black. Forewings deep purplish black with five pure white markings, namely, an outwardly oblique costal white streak near base, reaching the fold; an elliptical white spot on the middle of the wing; an angulate white costal spot at the beginning of the cilia; an opposite small dorsal white spot and a small white dot on the fold, below and forward of the central spot. Just before apex are found a few single white scales.

The ornamentation of the wing is precisely similar to that of the preceding species, *arizonella* Busck, with the addition of the last mentioned small white dot on the fold. Hindwings as broad as forewings, dark fuscous.

Abdomen above purplish black, below whitish. Legs dark fuscous with broad white bars on tibia and tarsi and with posterior coxæ white.

Alar expanse.—15 to 16 mm.

Habitat.—Colorado, Florida, South Carolina.

Type.—No. 6374, U.S.N.M.

This species is very close to the foregoing three species, especially to *arizonella* Busck, but at once distinguished from this by its pure white face and black head, by its light palpi and white barred legs, as well as by the slight difference in wing ornamentation.

The name of the species is a misnomer because while the types of the species came from Colorado I have subsequently identified it from Florida and South Carolina.

GELECHIA TRIALBAMACULELLA Chambers.

Gelechia trialbamaculella CHAMBERS, Cinn. Quart. Journ. Sci., II, 1875, p. 250;

Bull. U. S. Geol. Surv., III, 1878, p. 147—RILEY, Smith's List Lep. Bor.

Am., No. 5497, 1891—BUSCK, Dyar's List Amer. Lep., No. 5718, 1903.

Gelechia epigælla CHAMBERS, Journ. Cinn. Soc. Nat. Hist., III, 1881, p. 289.—

RILEY, Smith's List Lep. Bor. Am., No. 5359, 1891.

Types of both species with Chambers' labels on the pins are found in the Museum of Comparative Zoology in Cambridge, and prove, as the descriptions would indicate, that it is only one species twice described.

A large bred series, showing considerable variation in the white markings, is found in U. S. National Museum, determined by Lord Walsingham as *epigælla*.

Food plant—*Vaccinium stamineum*.—The following are the notes on this series in the U. S. Department of Agriculture, given under No. 2788:

An apparently very numerous larva of a skeletonizer on *Vaccinium stamineum* was found in Virginia (presumably by Mr. Theo. Pergande and near Washington City) on July 16. The larva fastens together two or more leaves and feeds between them on the epidermis, forming from its frass a tube, which is open at both ends. The larva is about 8 mm. long, pale dirty yellowish or greenish yellow, with six darker yellow stripes, head and cervical shield dark yellow; moths issued from July 26 to August 17.

Chambers' type was bred from the nearly related *Epigæa repens*.

In U. S. National Museum is another series of apparently this same species bred from sweet fern, *Comptonia asplenifolia*, and also identified by Lord Walsingham as *epigælla* Chambers. This would be an unusually diverse food plant for a Gelechiid, and I was suspicious that the latter series would prove another species, as it eventually may. But the rather ample material can not be separated at present except by the labels, and the notes on the larvæ are so similar that for the time being at least I must assume all to be one species.

Should it ultimately prove to be two species by more accurate observations on the larvæ, the species on *Comptonia* might properly be

given Chambers' first name, *trialbamaculella*, and his second name be retained for the feeder on *Vaccinium* and *Epigaea*.

GELECHIA CONFUSELLA Chambers.

- Gelechia confusella* CHAMBERS, Cinn. Quart. Journ. Sci., II, 1875, p. 251; Bull. U. S. Geol. Surv., IV, 1878, p. 142.—RILEY, Smith's List Lep. Bor. Am., No. 5342, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5719, 1903.
Depressaria persicivella MURTFELDT, Rep. Mich. St. Agr. Coll., 1899.
Gelechia persicivella MURTFELDT, Can. Ent., XXXII, 1900, p. 164.

Food plant.—*Prunus persica*.

Habitat.—Michigan.

Cotypes of Miss Murtfeldt's species are in U. S. National Museum under type No. 4697.

The species is very close to the foregoing and I have no doubt is the same as Chambers' *Gelechia confusella*, the type of which is lost, but the description of which tallies in every detail with the peach feeder.

GELECHIA BIMACULELLA Chambers.

- Depressaria bimaculella* CHAMBERS, Can. Ent., IV, 1872, pp. 108, 129, 147, 148.
Gelechia bimaculella CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 141.—RILEY, Smith's List Lep. Bor. Am., No. 5326, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5720, 1903.
Gelechia (?*Lita*) *ternariella* ZELLER, Verh. k. k. zool.-bot. Gesell. Wien., XXIII, 1873, p. 264, pl. III, fig. 19.
Gelechia ternariella CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 147.—RILEY, Smith's List Lep. Bor. Am., No. 5491, 1891.
Gelechia sylvaceolella CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, pp. 86, 147.—RILEY, Smith's List Lep. Bor. Am., No. 5489, 1891.

Type No. 440 in the U. S. National Museum of *Depressaria bimaculella*, labeled in Chambers' handwriting and dated 1872, agrees with his type specimen in the Museum of Comparative Zoology in Cambridge and shows that it is identical with Zeller's *ternariella*, type of which, in excellent condition, is also found in the Cambridge Museum. The type in U. S. National Museum bears besides Chambers' name label also another folded label in his handwriting: "Congeneric with *corcevisella* and perhaps a true *Gelechia*." It also bears Lord Walsingham's blue label no. 1168.

The type of *Gelechia sylvaceolella* Chambers is lost, but the description agrees well with the present somewhat variable species, and it seems proper to regard it as a variety of it, as suggested by Chambers.

Habitat.—Kentucky, Texas.

GELECHIA CONTINUELLA Zeller.

- Gelechia continuella* ZELLER, Isis, 1839, p. 198.—STAUDINGER and REBEL, Cat. Lep. Eur., II, No. 2597, 1901.—MOESCHLER, Wiener ent. Monatschr., 1864, p. 200.—GROTE, Can. Ent., IV, 1872, p. 126.—RILEY, Smith's List Lep. Bor. Am., No. 5343, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5721, 1903.
Gelechia trimaculella PACKARD, Proc. Bost. Soc. Nat. Hist., XI, 1867, p. 61.
Gelechia albomaculella CHAMBERS, Can. Ent., VII, 1875, p. 209; Bull. U. S. Geol. Surv., IV, 1878, p. 141.—RILEY, Smith's List Lep. Bor. Am., No. 5306, 1891.

Moeschler originally recorded *continella* from Labrador. In the Museum of Comparative Zoology in Cambridge are Packard's two types of *trinuculella*, also described from Labrador.

So far as the specimens, which are in poor condition, permit comparison, they agree in every respect with authentic European specimen of *continella* Zeller in U. S. National Museum. From the Beauger collection in Laval University, Quebec, I have obtained the unique type of Chambers' *Gelechia albamuculella*. It is in poor condition, without palpi and wings on one side, but recognizable, and undoubtedly authentic, with Chambers' label on the pin. It is same species as *trimaculella* Packard.

The types of the latter in Cambridge bear Lord Walsingham's blue labels no. 838-839, corresponding to his identification in his notebook,¹ *trinuculella* Packard.

The American specimens agree with the European in having veins 3 and 4 and 6 and 7 on hindwing shortstaked.

GELECHIA RIBESELLA Chambers.

Gelechia ribesella CHAMBERS, Cinn. Quart. Journ. Sci., II, 1875, p. 290; Bull. U. S. Geol. Surv., III, 1877, p. 128; Bull. U. S. Geol. Surv., IV, 1878, p. 146.—RILEY, Smith's List Lep. Bor. Am., No. 5467, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5722, 1903.

The unique type of this species is in the Museum of Comparative Zoology in Cambridge in good condition. It is a fine, well-described, and easily recognized species.

Chambers bred it from currant in Colorado at an altitude of 8,500 feet.

In the U. S. National Museum is a fine series, bred last summer from currant in Colorado by Dr. Harrison G. Dyar.

GELECHIA TROPHELLA, new species.

Gelechia trophella BUSCK, Dyar's List Amer. Lep., No. 5723, 1903.

Antennæ light silvery fuscous, with narrow black annulations. Second joint of labial palpi with well-developed brush, longer at base than at apex; silvery white liberally mottled with black; underside of brush black; terminal joint black, slightly sprinkled with white scales. Lower part of face and tongue ochreous; upper part of face, head, and thorax light fuscous, intermixed with white and black metallic scales. Basal half of forewings dark iridescent fuscous, liberally intermixed with white and black scales. At basal third is an oblique outwardly directed black costal streak, somewhat wider at its lower end on the cell. Outer half of forewings shining black, with sparse white scales around the edges. At apical third is a transverse, per-

¹ See preface, p. 768.

pendicular, slightly outwardly angulated white fascia across the wing. Cilia purplish white, with sparse black scales intermixed.

Hindwings as broad as forewings, light shining fuscous; cilia lighter yellowish fuscous. Abdomen light iridescent purplish fuscous. Legs bluish black, mottled with white scales; tarsi dark purple, with each joint tipped with white.

Alar expanse.—15 to 16 mm.

Food plant.—Oak.

Habitat.—Colorado.

Type.—No. 6375, U.S.N.M.

This species comes nearest *continuella* Zeller, but has the fascia well defined and is easily distinguished from that species by its dark head and long brush on the labial palpi.

The types were bred by Dr. Harrison G. Dyar, who has given me the following notes on the larva:

Larva.—Head and cervical shield black, body pale, thickly mottled with red brown, obscurely longitudinally lined and leaving pale spaces about the minute black tubercles. Dorsal line geminate, irregular; subdorsal broader, blotched below tubercle i; lateral and two subventral lines obscure. Thoracic feet black; anal plate brown bordered.

On oak in the Platte Canyon, Colorado. Imago June 18.

GELECHIA LUGUBRELLA Fabricius.

Gelechia lugubrella FABRICIUS, Ent. Syst., III, 1794, 2,299, 54.—STAUDINGER and REBEL, Cat. Lep. Eur., II, No. 2617, 1901.—BUSCK, Dyar's List Amer. Lep., No. 5724, 1903.

In Professor Fernald's collection are two specimens from Orono, Maine, determined by Lord Walsingham as *Gelechia lugubrella* Fabricius. They bear his blue labels no. 99 and 213 and undoubtedly belong to this European species, which must thus be included in the American list.

In the U. S. National Museum is a good series of European specimens.

The species is very distinct from its nearest allies and easily recognized by its two white wing markings, the oblique white streak at basal third and the narrow inwardly curved white fascia at apical third.

GELECHIA ALBILORELLA Zeller.

Gelechia albimorella ZELLER, Verh. k. k., zool.-bot. Gesell. Wien, XXIII, 1873, p. 261, pl. iii, fig. 16.—CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 141.—RILEY, Smith's List Lep. Bor. Am., No. 5303, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5725, 1903.

Gelechia trifasciella CHAMBERS, Cinn. Quart. Journ., II, 1875, p. 252; Can. Ent., IX, 1877, p. 24; Bull. U. S. Geol. Surv., IV, 1878, p. 147.—RILEY, Smith's List Lep. Bor. Am., No. 5498, 1891.

Type No. 464, in the U. S. National Museum, of *trifasciella*, with Chambers' label on the pin, is identical with two types in Cambridge

Museum; also with Chambers' labels. One of these bears Lord Walsingham's blue label No. 1004, corresponding to his identification in his notebook,¹ *trifasciella* Chambers.

These types agree exactly with Zeller's description and figure of *albilocella*, a specimen of which, identified by Lord Walsingham, is in U. S. National Museum.

This striking species is common in collections from Arizona, Colorado, and Texas.

GELECHIA DENTELLA, new species.

Gelechia dentella Busck, Dyar's List Amer. Lep., No. 5726, 1903.

Antennæ dark fuscous, with lighter faint annulations. Labial palpi with well-developed brush; second joint yellowish white; terminal joint white, with a fuscous annulation before the tip.

Face, head, and thorax yellowish white; shoulders black. Forewings black and yellowish white, as follows: Costal half from base to apical, two-fifths black, and entire apical two-fifths black except two small opposite costal and dorsal spots, which are yellowish white. Dorsal half of wing from base to apical, two-fifths yellowish white. The white part projects upward at apical two-fifths to the costal edge and has another slight projection into the costal black part at basal third of the wing. Cilia black.

Hindwings broader than forewings, light yellowish gray; abdomen light yellowish fuscous; legs yellowish white, barred with black.

Alar expanse.—9 to 10 mm.

Habitat.—Phoenix, Arizona.

Type.—No. 6376, U.S.N.M.

Cotypes in collection of Mr. William D. Kearfott, to whom I am indebted for this and the two following similar species.

Close to the following two species, *sistrella* and *abdominella*, but distinguished from them by the absence of any white on basal three-fifths of costal half of forewing.

GELECHIA SISTRELLA, new species.

Gelechia sistrella Busck, Dyar's List Amer. Lep., No. 5727, 1903.

Antennæ black, with narrow, indistinct white annulations; labial palpi with well-developed brush; second joint white; terminal joint white, sprinkled with black, and with tip black; face, head, and thorax white; shoulders black; forewing, deep black and pure silvery white, as follows: A broad longitudinal black in the middle of the wing, equidistant from the costal and dorsal edge, starting at base of costa and reaching one-half of the length of the wing, where it turns

¹See preface, page 768.

sharply rectangularly upward, reaching costal edge and thus inclosing a narrow, longitudinal costal white patch; apical two-fifths black, with two large rounded opposite costal and dorsal spots, white. The rest of the wing—that is, the basal half of the dorsal edge and a perpendicular, nearly straight fascia just outside the middle of the wing—is white. Cilia black, tipped with whitish; hindwings broader than forewings, silvery fuscous; abdomen dark fuscous and tuft yellowish; legs white, with black bars on the outside.

Alar expanse.—9 to 10 mm.

Habitat.—Phoenix, Arizona.

Type.—No. 6377, U.S.N.M.

Cotypes in collection of Mr. William D. Kearfott. Very similar to the preceding species, but at once distinguished by the white basal costal patch.

GELECHIA ABDOMINELLA, new species.

Gelechia abdominella Busck, Dyar's List Amer. Lep., No. 5728, 1903.

Antennæ black, with sharp white annulations. Labial palpi with second joint white; brush well developed; terminal joint white, with slight fuscous shading in front; tip white.

Face, head, and thorax white, with a faint ochereous tint; shoulders black.

Forewings black and white, as follows: Extreme base of costa black; a large triangular costal spot before the middle of the wing, with tip reaching beyond the fold, black, with a central dot on the costa, white. Apical two-fifths of wing black, with a costal and dorsal triangular white spot at the beginning of the cilia nearly or quite reaching each other with their thinly extended tips. Rest of forewing—that is, the dorsal three-fifths, with two upward projections reaching the costal edge on each side of the costal black triangular spot—white, with a faint ochereous tint. Cilia blackish.

Hindwings broader than forewings, light silvery gray. Abdomen and hindlegs light silvery salmon red; forelegs white, barred with black.

Alar expanse.—9 to 10 mm.

Habitat.—Phoenix, Arizona.

Type.—No. 6378, U.S.N.M.

Cotypes in collection of Mr. William D. Kearfott.

Very similar in size and general habitus to the two foregoing species; so similar that by superficial examination they might all be taken to represent one species, which, however, the constancy in their differences clearly shows that they are not. The present species is easily recognized by its peculiarly colored abdomen, as well as by the isolated triangular costal black spot.

GELECHIA BASQUELLA Chambers.

Oecophora basquella CHAMBERS, Can. Ent., VII, p. 92.

Gelechia basquella CHAMBERS, Can. Ent., VII, 1875, p. 124.—BUSCK, Dyar's List Amer. Lep., No. 5729, 1903.

Gelechia (?) *basquella* CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, pp. 87, 142.

Gelechia (*Bryothropa*?) *basquella* WALSINGHAM, Trans. Am. Ent. Soc. Phila., X, 1882, p. 178.

Gelechia basquella RILEY, Smith's List Lep. Bor. Am., No. 5329, 1891.—WALSINGHAM, Proc. Zool. Soc. Lond., 1897, p. 75.

Gelechia costipunctella MÖSCHLER, Abhand. d. Senckenb. naturf. Ges., XVI, 1889, p. 334.—WALSINGHAM, Proc. Zool. Soc. Lond., 1892, p. 519.

Chambers' type is in the Museum of Comparative Zoology, Cambridge, and is identical with specimens in Professor Fernald's collection and in Dr. William Dietz's collection, named by Lord Walsingham, who recorded this species from the West Indies and found the synonymy with Möschler's *costipunctella*.

I have collected this species at light in the District of Columbia and found its foodplant and larva there; I have also taken specimens in Kentucky, Key West, Florida, Porto Rico, and St. Thomas, West Indies. In the National Museum are, besides these specimens, others from Kansas, Iowa, and Texas.

The species has veins 3 and 4 in the forewings stalked, but agree otherwise with the definition of the present genus, and seems close to the three foregoing species. Veins 6 and 7 in hindwings are stalked.

Foodplant.—*Cassia chamaecrista*.

The larva is when full-grown about 10 mm. long, with head and thoracic shield and feet shining black and with the three thoracic segments, except anterior part of the third joint, deep purplish red; the rest of the body is green, with very small, deep black tubercles emitting short dark hairs.

Dr. Dyar has kindly drawn up the following technical description:

LARVA.—Head rounded, bilobed, full, oblique and retracted; mouth projecting; the labium and spinneret prominent; clypeus high, triangular, antennæ small; shining black, labium, and epistoma pale; width, .6 mm. Body cylindrical, normal; joints 2 to 3 and 12 to 13 tapering; thoracic feet distinct, the joints black ringed; abdominal feet slender, rather small, normal, the crochets in a complete ring about the small, circular plants; cervical shield large, transverse, rounded on the posterior corners, shining black, cut by a fine, faint, pale dorsal line; joints 2 and 3 entirely dark vinous except the neck in front of the cervical shield; joint 4 in the incisure in front and in a broad band on the posterior third of the same dark vinous, extending even on the venter. The white area thus formed on the anterior part of joint 4 on the otherwise uniformly red thorax appears irregularly edged and lumpy. Rest of body whitish, immaculate, greenish from the blood. Tubercles small, round, black but distinct, bearing short, stiff, dark setæ. On the thorax tubercles ia and ib are separate, iia and iib, iv and v united in pairs. On joint 3 the tubercle plates are large of ib, iia + iib and iv + v, but on joint 3 they are small, and the paired tubercles stand separate though contiguous; on the prothorax the prespiracular and subventral tubercles are large. On the abdomen tubercle i is dorsal and cephalad to ii, iii is near to the spiracle, above it, iv and

v contiguous, in line, vi subventral posteriorly, vii of three contiguous tubercles on the anterior side of the leg base, viii on the inner side of the leg base. Spiracles small, black ringed; anal shield pale brown, distinct; anal feet with brownish outer shields.

GELECHIA PAULELLA, new species.

Gelechia paulella Busck, Dyar's List Amer. Lep., No. 5730, 1903.

Antennæ dark brown with indistinct yellowish annulations. Labial palpi yellowish white with base of second joint and extreme tip of terminal joint brown. Brush well developed undivided face; head and thorax yellowish white, shoulders dark brown. Forewings shining dark blackish brown with white markings. Entire dorsal edge white, this color reaching up the fold except right at base and slightly crossing the fold with an oblate upward projection at apical third of the wing. Beginning at basal one-fourth of costa and reaching the costal white part is a sharply defined outwardly directed white fascia. At apical fourth of the wing and nearly perpendicular on the costal edge is another narrower white fascia, somewhat dilated on the costal edge.

Between these two fasciæ, at the middle of the wing, is a large nearly semicircular white costal spot.

Cilia white, sparsely sprinkled with dark brown scales.

The white markings show indistinctly through on the underside of the wings.

Hindwing broader than forewings, silvery pale gray, nearly white; cilia yellowish.

Abdomen light yellowish fuscous. Legs yellowish; tarsi sprinkled with fuscous.

Alar expanse.—13 to 23 mm.

Habitat.—Arizona, Colorado.

Type.—No. 6379, U.S.N.M.

This distinct and fine species is described from numerous specimens collected in Arizona and Colorado and received from several sources (Schwarz, Dyar, Gillette, Barnes).

The specimens vary very much in size, the largest being by far the commonest, but the ornamentation is constant, and I have no hesitation in including the small specimens as the same species.

The species comes nearest the following and *Gelechia packardella* Chambers, but clearly has a quite different ornamentation.

GELECHIA UNIFASCIELLA, new species.

Gelechia unifasciella Busck, Dyar's List Amer. Lep., No. 5731, 1903.

Antennæ deep black. Labial palpi with second joint pure white except the base, which is black on the outside; brush well developed, longer at base than at apex, not furrowed; terminal joint black, sprinkled on the outside toward the base with white scales.

Face, head, and thorax pure silvery white, patagia black. Forewings deep bronzy black, with dorsal edge below the fold, from base to cilia white, and with a white narrow inwardly curved fascia at apical fourth.

The black part of the wing is found, under a lens, to be slightly sprinkled with minute bluish white atoms.

Cilia white sprinkled with black scales. Hindwings broader than forewings, shining light fuscous, cilia with a yellowish tint.

Abdomen light silvery and purplish fuscous, with the two first joints yellowish above, below sprinkled with white.

Legs purplish black, sprinkled with white scales and with each joint slightly tipped with white.

Alar expanse.—18 mm.

Habitat.—Arizona.

Type.—No. 6380, U.S.N.M.

A striking and distinct species near the foregoing, collected at Williams, Arizona, in July, by Mr. H. S. Barber.

GELECHIA PACKARDELLA Chambers.

Gelechia packardella CHAMBERS, Bull. U. S. Geol. Surv., III, 1877, p. 143; IV, 1878, p. 145.—RILEY, Smith's List Lep. Bor. Am., No. 5437, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5732, 1903.

I have not yet definitely determined this species, the type of which is lost, but it evidently belongs in this immediate group and will, when found, easily be identified from the description.

Habitat.—Colorado.

GELECHIA ARISTELLA, new species.

Gelechia aristella BUSCK, Dyar's List Amer. Lep., No. 5733, 1903.

Antennæ dark, shining brown. Labial palpi with well-developed spreading furrowed brush, second joint light canary yellow, terminal joint whitish, sprinkled with sparse light fuscous scales. Face, head, and thorax light, clear canary yellow; patagia black.

Forewings deep purplish black with two conspicuous broad longitudinal canary-yellow streaks; one from base along and immediately below the costal edge to apical third; the other, which is broader, from base along and including the entire dorsal edge nearly to apex. Cilia dark purplish fuscous.

Hindwings much broader than forewings, light silvery fuscous, cilia still a shade lighter.

Abdomen light purplish gray; anterior joints above velvety yellowish.

Legs purple, sprinkled with white scales.

Alar expanse.—22 mm.

Habitat.—Arizona.

Type.—No. 6381, U.S.N.M.

Collected in July at Williams, Arizona, by Mr. H. S. Barber.

This beautiful large species, which can not well be mistaken for any described American species, may be at once distinguished by the yellow coloring and the longitudinal ornamentation.

GELECHIA THORACEALBELLA Chambers.

Gelechia thoracealbella CHAMBERS, Can. Ent., VI, 1874, p. 235; Cinn. Quart. Journ. Sci., II, 1875, p. 252; Bull. U. S. Geol. Surv., IV, 1878, p. 147.—RILEY, Smith's List Lep. Bor. Am., No. 5492, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5734, 1903.

Types of this species were examined in the Museum of Comparative Zoology in Cambridge and found to be identical with specimen in U. S. National Museum bearing Chambers' label, *Gelechia thoracealbella*.

Both are in poor condition, but recognizable from the description, and unlike any other species known to me.

Habitat.—Texas.

GELECHIA MINIMACULELLA Chambers.

Gelechia minimaculella CHAMBERS, Can. Ent., VI, 1874, p. 235.—BUSCK, Dyar's List Amer. Lep., No. 5735, 1903.

Gelechia minimaculella CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 145.—RILEY, Smith's List Lep. Bor. Am., No. 5410, 1891.

This species, of which the unique type is found in Cambridge, is very similar to the foregoing, *thoracealbella* Chambers, but distinguished by the small ochreous discal dots.

The type is in comparatively good condition, except lacking the palpi; but it is unspread, and consequently the venation has not been examined. I am, however, quite assured from its general appearance that it is a true *Gelechia*. It is a large blackish-brown species with light ochreous head, thorax, and (according to Chambers) labial palpi. The very faint small ochreous markings on the forewings are well described by Chambers.

Habitat.—Texas.

GELECHIA OCHREOSUFFUSELLA Chambers.

Gelechia ochreosuffusella CHAMBERS, Can. Ent., VI, 1874, p. 236; Cinn. Quart. Journ. Sci., II, 1875, p. 255; Bull. U. S. Geol. Surv., IV, 1878, p. 145.—RILEY, Smith's List Lep. Bor. Am., No. 5430, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5736, 1903.

Gelechia depressostrigella CHAMBERS, Can. Ent., VI, 1874, p. 236; Bull. U. S. Geol. Surv., III, 1878, p. 142.—RILEY, Smith's List Lep. Bor. Am., No. 5350, 1891.

Gelechia depressostrigella CHAMBERS, Cinn. Quart. Journ. Sci., II, 1875, p. 255.

Type no. 450 in the U. S. National Museum of *depressostrigella* is like the type in Professor Fernald's collection of that species and

the same as eight types in the Museum of Comparative Zoology in Cambridge labeled by Chambers *depressostrigella*.

All of these types agree with the description and are undoubtedly authentic.

So far as known to me no authentic specimen labeled *ochreosuffusella* is in existence, and the above synonymy is established merely on Chambers' evidence.

The two species are described from Texas, one right above the other,¹ and there, Chambers thinks, they are two different species, though he says that they resemble each other. He writes that the color of head and palpi are different in the two species, but does not give the color of one of them (*depressostrigella*), and the color given for the other suits his own authentic specimens of the first.

Later² he corrects his description somewhat and says that they may be one and the same species.

As the many types of *depressostrigella* show some little variation, it seems under the circumstances admissible to place the two names as synonyms, thus lessening the previous long list of unknown species.

Should future collecting reveal two closely similar species, which with sufficient probability can be referred to the two species, then, of course, the second name should be resurrected and retained for the species represented by the types.

In the U. S. National Museum, besides the type, there is one specimen labeled by Lord Walsingham, *Gelechia depressostrigella*. This, as all the types, came from Texas.

GELECHIA STRIATELLA, new species

Gelechia striatella BUSCK, Dyar's List Amer. Lep., No. 5737, 1903.

Antennæ shining dark brown, slightly serrate toward the tip. Labial palpi with well-developed furrowed brush, ocherous white, thickly sprinkled with black and gray scales, underside of brush nearly black.

Face whitish; head and thorax clothed with light bluish gray scales, each scale slightly tipped with black or gray, which produces to the naked eye a uniform dark-gray color.

Forewings with ground color light whitish gray, thickly sprinkled with darker gray, brown, and black scales, which are arranged in indistinct narrow longitudinal darker lines, somewhat more pronounced in the apical part of the wing, but even there not clearly perceptible to the naked eye. Along the fold and at the dorsal cilia the wing is faintly suffused with ocherous. Cilia whitish, sprinkled with black dots.

¹ Can. Ent., VI, p. 236.

² Conn. Quart. Journ. Sci., II, p. 255.

Hindwings a little broader than forewings, shining light ochereous fuscous; cilia golden gray.

Abdomen metallic yellowish fuscous, underside darker, sprinkled with black scales.

Forelegs on the outside black, on the inside whitish; tarsi black, each joint tipped with ochereous. The other legs are light gray, sprinkled with black scales; tuft on posterior tibial yellowish.

Alar expanse.—16 to 17.5 mm.

Habitat.—Arizona.

Type.—No. 6382. U.S.N.M.

This species is very near the foregoing, and I have tried hard to convince myself that it might be *ochreosuffusella* (distinct from *depressostrigella*), but I can not make the description apply.

The light whitish ground color and the fainter striation distinguish it from Chambers' ochereous brown species.

Described from more than forty specimens in good condition, all from Arizona, and mostly collected by Mr. E. A. Schwarz in Santa Rita Mountains in May.

This large series shows hardly any variation.

GELECHIA OCHREOSTRIGELLA Chambers.

Gelechia ochreostrigella CHAMBERS, Cinn. Quart. Journ. Sci., II, 1875, p. 247; Can. Ent., X, 1878, p. 54; Bull. U. S. Geol. Surv., IV, p. 145.—RILEY, Smith's List Lep. Bor. Am., No. 5431, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5738, 1903.

Not *Gelechia ochreostrigella* CHAMBERS, Bull. U. S. Geol. Surv., III, 1877, p. 126.

Chambers described two different insects under the name *Gelechia ochreostrigella*, types of both of which I have examined in the Museum of Comparative Zoology in Cambridge.

The last described is a *Gnarinoscema*, and will be found treated under that genus (p. 831).

The other (the present) species is a typical *Gelechia* quite similar to *ochreosuffusella*, but easily distinguished by its ochereous head and thorax and the dark, nearly black, basal costal part of the wing.

In the U. S. National Museum is a specimen from California, which was also the locality of the type.

GELECHIA HIBISCELLA, new species.

Gelechia hibiscella BUSCK, Dyar's List Amer. Lep., No. 5739, 1903.

Antennæ dark brown, not annulated, slightly serrate toward the tip.

Labial palpi with well-developed spreading brush, yellowish white; second joint with a few black scales on the outside; terminal joint with tip and one annulation near base black.

Face, head, and thorax shining ochereous white; shoulders purplish black. Costal half of forewings dark brown, in some specimens nearly

black; dorsal half including apex light ochereous brown, in some specimens whitish. The limit between these two parts of the wing is not very definite and somewhat variable.

In the dark costal part are found lighter, yellowish brown, irregular patches, one large indistinct at the middle of the costa, one small rather more distinct costal spot at the beginning of the cilia and in some specimens others not well defined. In the dorsal light part of the wing are ill-defined darker shadings and the veins are indicated darker so as to produce a striate effect. On the fold at the basal one-third is a small nearly black spot which seems to be constant. Likewise is a row of black dots around the apical edge constant in all my specimens. The other markings are more or less varying.

Hindwings a little broader than forewings, light bluish fuscous; cilia yellowish. Abdomen yellow. Legs dark purple with yellowish white bars on the outside and with tarsal white annulations.

Alar expanse.—16 to 17 mm.

Habitat.—District of Columbia.

Food plant.—*Hibiscus moscheutos*.

Type.—No. 6383, U.S.N.M.

This species is quite near to the foregoing species, *ochreostrigella* Chambers, but not so conspicuously streaked and with light, dark annulated, third joint of labial palpi instead of the uniformly dark, nearly black, terminal joint in *ochreostrigella*.

I have reared this variable, but always easily recognized species repeatedly from the common swamp rose mallow.

The larva is rather large when full grown in proportion to the imago, being 22–23 mm. long and with greatest width 2.2 mm. It is cylindrical, only slightly tapering fore and back. Head rounded, shorter than wide, black with reddish brown vertex; width, 1.3 mm. First thoracic segment somewhat narrower than the following joint, reddish; thoracic shield black; width, 1.6 mm.; length, 0.7 mm.; straight in front and nearly straight posteriorly. Second thoracic segment dark reddish, with anterior part white above. Third thoracic segment and the rest of the body white; on the posterior half of this joint begin six wavy narrow interrupted longitudinal dark reddish dorsal lines, which run through on all the rest of the segments. These lines are darker in the young larvæ, which otherwise are like the full-grown larvæ. Tubercles shining deep black, bearing short black hairs; they are arranged conspicuously on the white part between the dark lines. Ventral part of the abdominal segments white. Thoracic feet black; abdominal prolegs normal, white, with a complete circle of brownish hooks.

The larva feeds on the leaves or in the capsules, generally in large numbers together; when ready to pupate they partially bite off one or

more leaves, which thus dry up and crumple and afford convenient shelter; or others find room in the dried fruit or between it and the large surrounding calyx. The species overwinters as larva, and two generations are found in this locality, the imagoes issuing from the hibernated larva in May and from the summer brood in August.

GELECHIA COCKERELLI, new species.

Gelechia cockerelli Busck, Dyar's List Amer. Lep., No. 5740, 1903.

Antenna dark brown with indistinct yellow annulations. Labial palpi are long and slender, brush on second joint only slightly developed; white with a few dark scales; terminal joint somewhat darker, yellowish. Face yellowish white. Head and thorax rust yellow, thorax with three longitudinal blackish lines.

Forewings light yellowish brown, with dark blackish brown markings; on dorsal edge near base is a large dark brown patch, therein differing from the foregoing similar *ochreostrigella* Chambers and *hibiscella* Busck, which both have dorsal base light, but costal base dark; in the present species the costal base is of the general color of the wing. At apical third is a blackish ill-defined costal spot, which runs out in a dark shade across the wing. Just before this spot is another smaller, more sharply defined costal blackish spot. Along the veins and in the disk are longitudinal dark lines, sharpest and darkest in the apical part of the wing, and each terminating at the base of the cilia in a deep black spot. These longitudinal streaks are interrupted at the end of the cell by a short thin perpendicular deep black streak, followed by a short light brown space. Cilia reddish yellow, slightly sprinkled with black.

Hindwings broader than forewings, yellowish fuscous; cilia yellowish.

Abdomen light brown. Legs light brown shaded with darker brown; tarsi blackish with each joint tipped with yellow.

Alar expanse.—15 to 16.5 mm.

Habitat.—New Mexico, Arizona.

Type.—No. 6384, U.S.N.M.

Collected at light in May in Mesilla Park, New Mexico, by Mr. T. D. A. Cockerell, after whom I take pleasure in naming this species. Also collected by Mr. E. A. Schwarz at Catalina Springs, Arizona, in April.

GELECHIA VARIABILIS, new species.

Gelechia variabilis Busck, Dyar's List Amer. Lep., No. 5741, 1903.

The insects which I shall describe under this name and as varieties of this species represent, in my opinion, undoubtedly only one species, but is the most variable Gelechiid with which I am acquainted (except

it be *Ypsolophus ligulellus* Hübner), and it will be necessary to describe at least some of the varieties separately.

It has seemed reasonable to me that one or more varieties of this evidently common Western species should have been described by Chambers as one or more species, and I have especially carefully compared this species with the descriptions of his several unrecognized species, but I am unable to find any which I could make apply and feel justified in adopting the name of.

The specimens which I regard as typical may be recognized from the following:

Antennæ brown, with indistinct lighter annulations. Labial palpi slender; second joint whitish, suffused with brown; the brush only slightly developed, but divided and with a longitudinal dark streak in the middle; terminal joint nearly uniform dark fuscous, the whitish ground color being entirely covered.

Face, head, and thorax light ochreous gray. Forewings light grayish yellow, slightly brownish toward the tip and with blackish brown longitudinal lines from base to apex, following the veins and becoming heavier and more blackish toward apex. Three short more pronounced heavy black longitudinal lines independent of the others are very conspicuous and are found, although modified in all the varieties; the first and shortest at base just within dorsal margin; the second on the fold, also starting more or less clearly from the base, but reaching its characteristic thickness and tone outside the first line and ending as a heavy line just before the middle of the wing, though after continued as one of the general thin lines to the dorsal apical edge. The third line is midway between the fold and the costal edge and begins at the middle of the wing and reaches to the end of the cell; also continued as one of the fainter lines from base to apex.

Cilia gray. Hindwings as broad as forewings, yellowish fuscous; cilia yellowish. Abdomen light yellowish brown. Legs yellowish without any markings.

Variety a.—The three prominent longitudinal black streaks are intact, but the other longitudinal lines are nearly or quite obsolete. The color of the forewings below the three black lines is dark chocolate brown, the color above the lines whitish purple, the two colors standing sharply against each other, separated by the black lines.

The color of head and thorax is correspondingly dark brown.

Variety b.—Ground color of forewings more whitish, thickly suffused with dark brown and gray single scales. The three heavy black longitudinal streaks are present, but with a tendency to break up in shorter streaks or totally disappear, especially the first and the third, which are represented as one, two, or three longitudinal dots.

The other longitudinal lines are obsolete, except right around apex, where they are indicated by a series of short indistinct streaks at base of the cilia.

Besides these two extreme varieties all intermediate forms occur between them and what I call the normal form. While single specimens of the extreme varieties might easily be taken for different species and while absolute proof to the opposite can not be obtained except through breeding, I have no doubt but that they all belong to one variable species.

Alar expanse.—19 to 20 mm.

Habitat.—California, Colorado.

Type.—No. 6385, U.S.N.M.

Described from some 20 specimens of all varieties in the U. S. National Museum: many others have been examined in the collections of Messrs. Dietz, Kearfott, and Gillette.

GELECHIA TRILINEELLA Chambers.

Gelechia trilineella CHAMBERS, Bull. U. S. Geol. Surv., III, 1877, p. 125; IV, 1878, p. 147.—RILEY, Smith's List Lep. Bor. Am., No. 5499, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5742, 1903.

In the Museum of Comparative Zoology in Cambridge I found six types of this species, authenticated by Chambers' labels and agreeing with his description. They are all, however, much faded. A fresh specimen in U. S. National Museum, which I have compared with the types, exhibits the detail of the description better. Similar good specimens I have examined in Dr. Dietz's collection, determined independently by him from the description.

Habitat.—Colorado, Arizona.

GELECHIA BIANULELLA Chambers.

Oeseis bianulella CHAMBERS, Cinn. Quart. Journ. Sci., 1875, p. 225; Bull. U. S. Geol. Surv., IV, p. 159; Journ. Cinn. Soc. Nat. Hist., II, 1880, p. 202, fig. 15.—RILEY, Smith's List Lep. Bor. Am., No. 5579, 1891.

Gelechia bianulella BUSCK, Dyar's List Amer. Lep., No. 5743, 1903.

Gelechia? ocellella CHAMBERS, Bull. U. S. Geol. Surv., III, 1877, p. 126.

Gelechia ocellella CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 145.—RILEY, Smith's List Lep. Bor. Am., No. 5428, 1891.

I have examined type of *Gelechia ocellella* in Professor Fernald's collection and types of the same in Cambridge Museum: they are identical and agree with his description.

The synonymy with *Oeseis biannulella* I did not discover before I saw in Dr. Dietz's collection a specimen labeled by Lord Walsingham *Oeseis biannulella*. No authentic specimen from Chambers of this species exists, but I have no doubt that the specimen is rightly named by Lord Walsingham, as it faithfully agrees with Chambers' description, and if so it is the same as *Gelechia ocellella*. The description of the two species are nearly identical and could well both have been drawn from the same specimen.

GELECHIA DISCOOCELLELLA Chambers.

Gelechia discoocellella CHAMBERS, Can. Ent., IV, 1872, p. 194.—BUSCK, Dyar's List Amer. Lep., No. 5744, 1903.

Gelechia discoocella CHAMBERS, Can. Ent., VI, 1874, p. 231.

Gelechia discoocella CHAMBERS, Cinn. Quart. Journ. Sci., 1875, II, p. 237; Bull. U. S. Geol. Surv., IV, 1878, p. 143.—RILEY, Smith's List Lep. Bor. Am., No. 5355, 1891.

Gelechia discoocella COQUILLET, Papilio, III, 1883, p. 98.

Gelechia discoocella DIETZ, Smith's List Ins. N. Jersey, 1900, p. 474.

Gelechia violaceofusca ZELLER, Verh. k. k. zool.-bot. Gesell. Wien, XXIII, 1873, p. 258.—CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 148.—RILEY, Smith's List Lep. Bor. Am., No. 5510, 1891.

Zeller omitted to mention in his description of *violaceofusca* the ocellate spot at the end of the cell, which, though very indistinct in some lights, is plainly found in his unique well-preserved type in the Cambridge Museum. This type is a male and the spot is not nearly so prominent in this sex as in the females.

It is clearly the same species as represented by Chambers' four types of *discoocellella* also found in the Cambridge Museum and answering to his description of that species.

Chambers' name has precedence.

The ocellate spot at the end of the cell, as well as the lighter streak below the fold, are, as Chambers observed, somewhat variable, and especially in the males, indistinct; but the glossy violet sheen and the abruptly cut forewings makes this species easily recognized.

In the U. S. National Museum and in the collections of Professor Fernald and Dr. Dietz are specimens determined by Lord Walsingham as *Gelechia (Trichotaphe) discoocellella*. The species has, it is true, some general resemblance to the genus *Trichotaphe*, but palpi and venation place it in *Gelechia*.

Mr. Coquillet has given its food plant as Polygonum. This agrees with a note from Miss Murtfeld that she reared the types from *smart-weed*, *Polygonum hydropiperoides*, not, as Chambers wrote,¹ "small weed."

This species has a noteworthy color resemblance with another polygonum-feeding Tineid, *Aristotelia absconditella* Walker (p. 801).

It has a wide distribution; Chambers recorded it from Kentucky and Texas; Zeller from Texas; Coquillet from Illinois; in U. S. National Museum are specimens from Kansas (Crevecoeur), Illinois (Barnes), Pennsylvania (Dietz), District of Columbia (Busck).

GELECHIA ANARSIELLA Chambers.

Gelechia anarsiella CHAMBERS, Bull. U. S. Geol. Surv., III, 1877, p. 126.—RILEY, Smith's List Lep. Bor. Am., No. 5310, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5745, 1903.

¹Cin. Quart. Journ. Sc., II, 1875, p. 237.

On the label of the type of this species in the Museum of Comparative Zoology in Cambridge is a note in Frey's handwriting:

After the palpi it is an *Ypsolophus*.—Frey.

It is true that the brush on second joint of labial palpi is strongly developed, but not in the long projecting pointed fashion found in *Ypsolophus*; it is a large divided spreading brush, just like that found in *Gelechia* (*Oeseis*) *bianulella* Chambers, and I do not consider it of generic value, but merely the extreme development of the brush as commonly found in *Gelechia*, with which genus *anarsiella* also agrees in venation and general habitus.

In U. S. National Museum is an identical specimen labeled by Chambers; there is also a fine specimen bred by Dr. Harrison G. Dyar from *Ceanothus* in Colorado.

According to Dr. Dyar, the larva hides in a silken tube in a folded leaf, or between leaves.¹

GELECHIA PRAVINOMINELLA Chambers.

Gelechia quadrimaculella CHAMBERS, Cinn. Quart. Journ. Sci., II, 1875, p. 290; Bull. U. S. Geol. Surv., III, 1877, p. 128.

Gelechia pravinominella CHAMBERS, Can. Ent., X, 1878, p. 50; Bull. U. S. Geol. Surv., IV, 1878, p. 146; RILEY, Smith's List Lep. Bor. Am., No. 5451, 1891; BUSCK, Dyar's List Amer. Lep., No. 5746, 1903.

Not *Gelechia quadrimaculella* CHAMBERS, Can. Ent., VI, 1874, p. 237 (see *Anacamptis rhoifrutella*, p. 845).

As this species, the type of which is lost, I have identified a specimen which agrees with Chambers' short description and which was taken in the same locality from where Chambers' type came.

It was bred by Dr. Dyar from cottonwood in Colorado.¹

GELECHIA BARNESIELLA, new species.

Gelechia barnesiella BUSCK, Dyar's List Amer. Lep., No. 5747, 1903.

Antennæ simple dark fuscous. Labial palpi very long, slender; brush on second joint short and even; second joint whitish, sometimes with a rose tint, sprinkled with brown; terminal joint long, but shorter than the very long second joint, thin, pointed, whitish, sprinkled with black and dark brown. Head brown, loosely scaled, nearly tufted, and with a peculiar strong pointed horny frontal protuberance. Face somewhat lighter.

Forewings brown, of a somewhat variable shade in different specimens, from a reddish or deep purple brown to a lighter ashy or yellowish brown. At base of costa is a dark blackish spot, sometimes continued into an obscure oblique streak across the wing. On the middle of the disk is a short oblique blackish streak, and just below this another similar but fainter streak, together forming an arrow-

¹Described by Dr. Dyar, Proc. U. S. Nat. Mus., XXV, 1902, p. 407.

head pointing toward the tip of the wing. At the end of the disk is a short perpendicular blackish streak edged with light scales. A little before apical third is a large, dark, ill-defined costal spot; on apposite on the dorsal edge is another similar spot. Around apical edge is a series of blackish spots, with the intervening spaces rather lighter than the general color of the wing.

Hindwings as broad as forewings, light silvery fuscous. Abdomen light yellowish brown. Legs whitish fuscous speckled with darker brown, each joint of tarsi tipped with white.

Alar expanse.—22 to 27 mm.

Habitat.—Colorado.

Type.—No. 6386, U.S.N.M.

Described from some thirty specimens collected by Dr. W. Barnes, in honor of whom the species is named, and by Messrs. Gillette and Schwarz.

The ornamentation is sometimes not very distinct, and the ground color shows some variation in shade, but the species is quite different from any described and easily recognized by its size, the very long evenly brushed palpi, and especially by the peculiar frontal horn, which is found both in the males and females. It is found also in a less marked degree in *Gelechia variabilis* Busck (p. 871).

GELECHIA LINDENELLA, new species.

Gelechia lindenella Busck, Dyar's List Amer. Lep., No. 5748, 1903.

Antennæ light yellow, black at base and indistinctly annulated with dark fuscous. Labial palpi with brush short and even; terminal joint as long as second; ocherous white, sprinkled with black scales; tip of terminal joint black. Face white; head and thorax light ocherous. Forewings light ocherous, sprinkled with darker ocherous and black scales, especially along dorsal edge and toward apex, where the dark scales are arranged in indistinct longitudinal streaks between the veins. There are three black or very dark brown equidistant costal spots, one near the base, one at apical third, and one between these two. The one nearest base is the smallest, the next somewhat larger, and the outermost the largest. Just below this last is, at the end of the disk, an inconspicuous short and thin perpendicular line. On the middle of the wing is an inconspicuous dark brown dot, and just below on the fold is a similar dot. Around the apical edge is an indistinct row of small diffused blackish dots at base of cilia. Hindwings fully as wide as forewings, yellowish white. Abdomen ocherous fuscous. Legs ocherous, sprinkled with black. Tarsi black with each joint tipped with yellow.

Alar expanse.—13 to 17 mm.

Habitat.—Texas, Colorado, Arizona.

Type.—No. 6387, U.S.N.M.

Described from many Texan specimens, from Mr. William Beutenmüller's collection, and from specimens collected by Messrs. E. A. Schwarz and H. S. Barber in Colorado and Arizona.

It is a very distinct species, recognized by the pale color and the three black costal spots. The ornamentation recalls *Epithectis bicostomaculella* Chambers [p. 817.]

GELECHIA DYARIELLA, new species.

Gelechia dyariella Busck, Dyar's List Amer. Lep., No. 5749, 1903.

Antennæ whitish fuscous, indistinctly annulated with darker fuscous. Labial palpi with normal well-developed brush; terminal joint shorter than second; whitish suffused with bluish black scales on the outside; brush and terminal joint nearly black. Face white with a few light fuscous scales. Ground color of head, thorax, and forewings whitish, but so heavily overlaid with dark fuscous and bluish black scales as to give the appearance to the naked eye of dark gray. At the base is an oblique, ill-defined, obscure, blackish streak; on the middle of the wing is a black oval dot followed by a short space of pure white; at apical third is a large transverse blackish area across the wing, edged on the outside by a narrow zigzag white fascia. Hindwings as broad as forewings, light silvery fuscous, darker toward apex; cilia yellowish fuscous. Abdomen silvery gray; first segments velvety yellow on upper side; under side white. Legs white, profusely sprinkled with bluish black scales.

Alar expanse.—14 to 18 mm.

Food plant.—Cottonwood.

Habitat.—Colorado.

Type.—No. 6388, U.S.N.M.

An obscurely marked species near the following, *Gelechia albisparsella*. Described from a large series bred by Dr. Dyar, who has given me the following notes on the larva:

Larva.—Resembling the larva of *Nycteola* (*Sarothripa*). Slender, thorax and joint 13 smaller than the other segments, submoniliform; head whitish testaceous, darker in the sutures and vertex, ocelli black. Body all rather opaque soft green, the incisures folded, dorsal vessel dark green, male glands whitish, small. Cervical shield like the body, but more shining and luteous tinted; feet normal, pale; joint 13 dorsally dark punctate. Tubercles ia and ib separate, iia + iib, iv + v, the latter on both thorax and abdomen.

On cottonwood, Denver, Colorado. Folding up a young leaf by uniting the edges around the margin so that it forms a bag or box; solitary. The larvæ turned pink on leaving the bags to spin. Imago July 3.

GELECHIA ALBISPARSELLA Chambers.

Depressaria albisparsella Chambers, Can. Ent., IV, 1872, p. 92 and p. 128.

Cirrhoa platanella Chambers, Can. Ent., IV, 1872, p. 146; Bull. U. S. Geol. Surv., IV, 1878, pp. 118, 146.—RILEY, Smith's List Lep. Bor. Am., No. 5285, 1891.

Gelechia albisparsella Busck, Dyar's List Amer. Lep., No. 5750, 1903.

Two undoubtedly authentic types of this species labeled by Chambers, *Cirrha platanella*, are found in the Museum of Comparative Zoology in Cambridge and prove that the genus *Cirrha*, which can hardly be said to have been characterized by Chambers' few lines of general remarks, is synonymous with *Gelechia*. Chambers changed his specific name when he discovered the food plant, which was not admissible, and the species must be known under its original specific name.

Food plant.—*Plantanus occidentalis*.

Habitat.—Kentucky.

GELECHIA UNCTULELLA Zeller.

Gelechia unctulella ZELLER, Verh. k. k. zool.-bot. Gesell. Wien., XXIII, 1873, p. 257.—CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 147.—RILEY, Smith's List Lep. Bor. Am., No. 5503, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5751, 1903.

The unique type in good condition is in Cambridge Museum. Zeller mentions only two black dots, one on the disk and one at the end of the disk, and says: "Andere Zeichnungen fehlen." These two spots are the most prominent and the only ones seen in certain lights against the nearly black general color of the wing, but as a matter of fact there is, as type also shows, three other smaller black spots on the fold and one more on the disk. All of the spots, however, are quite indistinct.

In the U. S. National Museum is a very large bred series of this species from Colorado and Arizona, bred respectively by Dr. H. G. Dyar and Mr. E. A. Schwarz from *Thermopsis* and from *Robinia*.

Dr. Dyar has published his notes on the larva.¹

According to Mr. Schwarz, this species is at some places so abundant as to do actual damage, spinning up every leaflet of the *Robinia*.

GELECHIA OBSCUROOCELELLA Chambers.

Gelechia obscuroocellella CHAMBERS, Cin. Quart. Journ. Sci., II, 1875, p. 254; Bull. U. S. Geol. Surv., IV, 1878, p. 145.—RILEY, Smith's List Lep. Bor. Am., No. 5424, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5752, 1903.

Type of this species is lost, and no authentic specimen is found, but I have with little hesitation determined from description as this species a specimen from San Antonio, Texas, collected in May, which in every respect agrees with Chambers' description, and which, I have no doubt, truly represents this species.

GELECHIA VERSUTELLA Zeller.

Gelechia versutella ZELLER, Verh. k. k. zool.-bot. Gesell. Wien., XXIII, 1873, p. 253.—CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 148.—BUSCK, Dyar's List Amer. Lep., No. 5753, 1903.

¹Proc. U. S. Nat. Mus., XXV, 1902, p. 407.

The unique type of this species is found in the Cambridge Museum in excellent condition. A good bred series in the U. S. National Museum carefully compared with the type bears the designation "U. S. Dept. of Agriculture Insectary, Nos. 4232 and 5786," and the corresponding records show that it has been bred twice, first from larva skeletonizing leaves of cottonwood, received from El Paso, Texas, in November, 1887, from which the moths issued in January next year. The note on the larva is very short:

Greenish white, with a pink blush on dorsal surface.

Secondly, it was received in July, 1893, from Jetsam, Wyoming, with the report that the larvæ were extremely injurious to cottonwood. With this is the following note on the larva:

Head pale brown, with posterior margin black; body pale yellowish white without any markings. The moths issued July 3 to 8.

The Texan specimens average a little lighter and smaller than those from Wyoming, but they are undoubtedly same species. The type, although from Texas, agrees with the darker Wyoming specimens. Finally, there is in the National Museum one specimen of this species, bred by Dr. Dyar from cottonwood in Colorado.

This species is extremely similar to the following in ornamentation and easily mixed with it. The palpi, however, give a good distinguishing character. In the present species the brush is normal and well developed, longer at base than at apex of second joint, while *Gelechia lynceella* has a very short and even brush. The palpi also show color differences as pointed out by Zeller.

GELECHIA LYNCEELLA Zeller.

Gelechia lynceella ZELLER, Verh. k. k. zool.-bot. Gesell. Wien, XXIII, 1873, p. 255.—CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 144.—RILEY, Smith's List Lep. Bor. Am., No. 5403, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5754, 1903.

Type is found in good condition in the Cambridge Museum. I have met with no other specimen. Very similar to the foregoing.

Habitat.—Texas.

GELECHIA BICOSTOMACULELLA Chambers.

Depressaria bicostomaculella CHAMBERS, Can. Ent., IV, 1872, pp. 127, 147; Bull. U. S. Geol. Surv., IV, 1878, p. 138.

Adrastraia quercifoliella CHAMBERS, Can. Ent., IV, 1872, p. 206; V, 1873, p. 174.

Gelechia quercifoliella, CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 146.—RILEY, Smith's List Lep. Bor. Am., No. 5461, 1891.

Psoricoptera gibbosella CHAMBERS (not Stainton), Can. Ent., V, 1873, p. 72.

Gelechia bicostomaculella DRETZ, Smith's List Ins. N. Jersey, 1900, p. 474.—BUSCK, Dyar's List Amer. Lep., No. 5755, 1903.

Not *Gelechia bicostomaculella* CHAMBERS, Bull. U. S. Geol. Surv., III, 1877, p. 127; IV, 1878, p. 141.—RILEY, Smith's List Lep. Bor. Am., No. 5322, 1891.

The second species which Chambers described as *Gelechia bicostomaculella* from Colorado is an *Epitheatis* and is treated on p. 817 under that genus.

Of the present species no authentic type is in existence, but in the U. S. National Museum are two specimens determined by Lord Walsingham, and similar specimens in the collection of Dr. Dietz and Professor Fernald, also determined as *bicostomaculella* by Lord Walsingham. Some of these specimens are bred by Miss Murtfeldt from oak, and bear her breeding number 174 M. Miss Murtfeldt thinks this the true *bicostomaculella*, and as it agrees with Chambers' description it seems altogether probable that this truly is that species.

The species is near the following and *Gelechia vernella* Murtfeldt, but has raised scales on the forewings, in which character, as well as in the stalked veins 6 and 7 in the hindwings and the slightly parted veins 3 and 4 it approaches the genus *Telyphusa*.

GELECHIA NIGRIMACULELLA, new species.

Gelechia nigrimaculella RILEY, Smith's List Lep. Bor. Am., No. 5418, 1891.—
BRECK, Dyar's List Amer. Lep., No. 5756, 1903.

In Riley's List of Tineina is found, under no. 5418, the name *Gelechia nigrimaculella* Chambers, and in U. S. National Museum is a large apparently bred series labeled with this same name. But no description has ever been printed of the insect, which I now describe under the old manuscript name given by Chambers.

Antennæ dark fuscous. Labial palpi with normal well-developed brush; ocherous strongly suffused with black except tips of second and third joint, which are clear ocherous. Face, head, and thorax brownish sprinkled with fuscous and blackish scales. Ground color of forewings whitish fuscous but obscured by a liberal sprinkling of dark-brown and black scales. An ill-defined longitudinal streak below costal edge is whitish; costal edge nearly black; on the middle of the disk is an oblique short black dash, and just below this a similar one. At apical third is an obscure outwardly angulated narrow white fascia, and just before this is a costal and a dorsal blackish spot nearly reaching each other. Cilia whitish.

Hindwing as broad as forewings, light fuscous, darker toward tip. Abdomen yellowish fuscous above, below white. Legs whitish sprinkled with black; tarsal joints black tipped with white.

Alar expanse.—13 to 15 mm.

Habitat.—New York, New Jersey.

Type.—No. 6389 U.S.N.M.

Very close to the Californian *Gelechia occidentella* Chambers, but differing by its dark face. Described from many specimens collected by Mr. William Beutenmüller, and found in U. S. National Museum labeled "*Gelechia nigrimaculella* Chambers."

GELECHIA MACULIMARGINELLA Chambers.

Gelechia maculimarginella CHAMBERS, Can. Ent., VI, 1874, p. 241.—BUSCK, Dyar's List Amer. Lep., No. 5757, 1903.

Gelechia maculomarginella CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 144.—RILEY, Smith's List Lep. Bor. Am., No. 5405, 1891.

Authentic types of this species are found in Professor Fernald's collection and in the Cambridge Museum; the latter are in miserable condition, but agree with Professor Fernald's type as far as can be made out and with Chambers' descriptions. I have bred large series of this species in the District of Columbia and vicinity. The larva feeds on different kinds of oak, and there are at least two generations in this locality. The larva is among the earliest found in the spring (April) in the half-developed unfolded leaves or buds.

The imago of this brood is in the middle of May. In June there is a second brood feeding between two spun-together leaves; imagoes issue in the latter part of July.

Very probably there is a third autumn brood, which either overwinter and lay eggs in early spring, in the swelling leaf buds, or which lay their eggs on the bud, all ready in the autumn.

The easily recognized larva is slender and very agile. Head and thoracic plate polished jet black; first and second thoracic segments deep purple, third, lighter purple with anterior half white. Abdominal segments whitish with four (two on each side) longitudinal purple lines connected on each joint by a broad purple band, which sends two small dorsal projections forward into the white part on each joint.

Thoracic feet and anal plate black; length of full-grown larva 14 mm.; width of head 0.9 mm.

This species as well as *Gelechia vernella* and *Gelechia bicostomaculella* have the hairs on vein 1b in the hindwings of the male strongly developed, resembling a tuft or pencil of long blackish hairs.

GELECHIA BIMINIMACULELLA Chambers.

Gelechia himinimaculella CHAMBERS, Cinn. Journ. Nat. Hist., II, 1880, p. 183.—

RILEY, Smith's List Lep. Bor. Am., No. 5327, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5753, 1903.

The type in Cambridge Museum of this species, with Chambers' label on the pin and agreeing with his description, was found to be identical with a series in U. S. National Museum bred from oak in Missouri by Miss Murtfeldt, and determined by her as this species. I have not met with other specimens.

GELECHIA PSEUDOACACIELLA Chambers.

Depressaria pseudoacaciella CHAMBERS, Can. Ent., IV, 1872, pp. 9, 107, 129, 147, 148.

Gelechia pseudoacaciella CHAMBERS, Cinn. Quart. Journ. Sci., I, 1874, p. 208; Geol. Surv. Bull. U. S., IV, 1878, p. 146; Psyche, III, 1880, p. 65.—RILEY, Smith's List Lep. Bor. Am., No. 5453, 1891.

Proc. N. M., vol. xxv--02—56

Gelechia cæcella ZELLER, Verh. k. k. zool.-bot. Gesell., Wien, XXIII, 1873, p. 252.—CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 142.—RILEY, Smith's List Lep. Bor. Am., No. 5331, 1891.

Of this very common insect, the larva of which was shortly described by Chambers, there is a large series in U. S. National Museum, among which are specimens determined by Chambers and by Lord Walsingham. I have repeatedly bred it from *Robinia pseudacacia* around Washington, and I have seen it from most of the Eastern States.

The specimens, which Riley bred from wild cherry, and which Chambers could not distinguish from *pseudomacaciella*,¹ are still in U. S. National Museum and belong to another perfectly distinct though quite similar species, described in this paper as *Gelechia serotinella*.

I am indebted to Lord Walsingham for the synonymy of Zeller's *Gelechia cæcella*, type of which is in his possession and which he has given me his manuscript notes on.

The description fully bears out this synonymy.

GELECHIA SEROTINELLA, new species.

Gelechia serotinella BUSCK, Dyar's List Amer. Lep., No. 5760, 1902.

Gelechia pseudoacaciella CHAMBERS, Psyche, III, 1880, p. 65.

Antennæ shining purplish black, with very narrow white indistinct annulations; labial palpi with second joint above whitish, strongly sprinkled with black scales; under side of the well-developed brush black; terminal joint black, with extreme tip and a few scattered scales white.

Face whitish, overlaid with dark purple. Head and thorax clothed with mixed white and purplish black scales, the latter predominating; forewings dark, black and white scales irregularly mixed, but the black prevailing; in a narrow longitudinal streak along but below costal edge dark-brown scales are also freely intermixed, giving that part of the wing a perceptible chocolate-brown shade. At the end of this streak at apical fourth the white scales congregate in an ill-defined costal white spot, which is connected with an opposite equally ill-defined dorsal white spot by a wavering interrupted narrow white fascia. Cilia dark fuscous, intermixed with white and with two faint blackish lines parallel with the edge of the wing.

Hindwings as broad as forewings, dark shining fuscous; cilia, light fuscous; abdomen above on the first segments velvety yellowish brown; the other segments and under side very dark shining fuscous; legs with white and dark purple scales intermixed; posterior tibia on the outside black, with two white bars, on the inside silvery white; tarsal joints black, tipped with white.

Alar expanse.—16 to 21 mm.

Food plant.—*Prunus serotina*.

¹ Psyche, III, 1880, p. 65.

Habitat.—District of Columbia; Colorado.

Type.—No. 6390, U.S.N.M.

The species is very near the foregoing, *pseudocaciella*, and it was very natural that Chambers, from the imago alone, should identify it as that species; but it is a larger and darker insect, without the whitish costal area found in *pseudocaciella*.

The egg of this species is laid on the upper side at the tip of a leaf of wild cherry. The young larva spins together the edges of the leaf, and as it grows it folds gradually the entire leaf into a roomy abode, the open end of which it covers with a glistening white, thickly woven sheet of silk. In this cell the larva lives in a black tube made from its own frass and spun firm by silk, and it feeds under the protecting sheet of silk, which is gradually enlarged and moved outward as new feeding ground is needed. The larva is very timid and retreats at the least disturbance into its tube of frass, which it, when full grown, forms into an oval cocoon, in which it pupates. The imago issues within the cell and breaks through the sheet of silk.

The larva is very similar to that of *pseudocaciella*. When young it has a black head and thoracic shield, body dirty greenish white, darkest on the under side, and with two narrow longitudinal dark-brown dorsal lines and four (two on each side) broader lateral lines through all the segments.

When full grown the larva measures 21–24 mm. in length, with head 1.6 mm. broad. Head and thoracic shield is then light brown, the ground color of the body more nearly white, and the stripes more reddish.

Dr. Dyar, who has bred this insect from larva with identical habits in Colorado, has kindly given me the following technical description of the larva:

Head broad, red-brown, sutures and ocellar area blackish. Body purple brown with white stripes, narrower than the intervening spaces; irregular dorsal line, subdorsal (over tubercles i and ii), lateral (over iii), and broken, broad, distinct, subventral (over iv + v and vi). Feet brownish; cervical shield black behind and shading to sordid white before, rather transparent on anterior rim; prespiracular tubercle black. Tubercles small, brown. Thoracic feet black; anal plate luteous; setæ fine and pale; abdominal feet reddish, those of joint 13 partly pale.

In the locality of Washington there are two annual generations. The young larvæ are first found in May, and in early June they are full grown and already pupated. Imagoes issue late in July and early in August, and lay their eggs soon after, producing the second generation, which overwinters as full-grown larva in its cocoon and issues as imago next spring.

The peculiar life mode of the larva and its elaborate architecture reminded me at once, when I found it two years ago, of Clemens' description of his genus *Catastega*, which was founded solely on the

habit of the larva. As Dr. Dyar has since shown,¹ this genus must be included in the Tortricidæ, and has nothing to do with the present species: but the life mode is identical with that described by Clemens, and illustrates how dangerous it is to rely on earlier stages alone in making new specific and generic groups.

GELECHIA VERNELLA Murtfeldt.

Gelechia formosella MURTFELDT (not Hübner), Can. Ent., XIII, 1881, p. 243.—RILEY, Smith's List Lep. Bor. Am., No. 5364, 1891.

Gelechia vernella MURTFELDT, Can. Ent., XV, 1883, p. 139.—RILEY, Smith's List Lep. Bor. Am., No. 5508, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5761, 1903.

Cotypes of this species are in U. S. National Museum, and I have obtained additional material through the kindness of Miss Mary Murtfeldt.

Food plant.—Oak.

Habitat.—Missouri.

I have not recognized this species from other localities.

GELECHIA SEQUAX Haworth.

Recarvaria sequax HAWORTH, Lepidoptera Brit., 1829, p. 552.

Gelechia (Teleia) sequax STAUDINGER and REBEL, Cat. Lep. Eur., II, No. 2741, 1901.—ZELLER, Verh. k. k. zool.-bot. Gesell. Wien, XXIII, 1873, p. 265.—CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 147.—RILEY, Smith's List Lep. Bor. Am., No. 5478, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5762, 1903.

This European species was included in the American list, on Zeller's authority, from Massachusetts.

I have not met with any specimen from America, and it seems probable that some mistake was made in the labeling of Zeller's specimen or in his determination.

In the U. S. National Museum is a good series of European specimens.

The larva lives, according to Meyrick, in spun shoots of *Helianthemum*.

GELECHIA OCCIDENTELLA Chambers.

Gelechia occidentella CHAMBERS, Cinn. Quart. Journ. Sci., II, 1875, p. 246; Bull. U. S. Geol. Surv., IV, 1878, p. 145.—RILEY, Smith's List Lep. Bor. Am., No. 5427, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5763, 1903.

In the Museum of Comparative Zoology, in Cambridge, are found three probably authentic types of this species. They are true *Gelechia* and can be recognized also specifically, although they are in poor condition and have lost their palpi. I have met with no specimens exactly like them.

Habitat.—California.

¹See p. 852.

GELECHIA MEDIOFUSCELLA Clemens.

- Gelechia mediofuscella* CLEMENS, Proc. Ent. Soc. Phila., II, 1863, pp. 11, 121; Stainton Ed. N. Am. Tin., 1872, pp. 218, 224.—CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 144.—RILEY, Smith's List Lep. Bor. Am., No. 5407, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5764, 1905.
- Gelechia vagella* WALKER, Cat. Lep. Het. Brit. Mus., XXIX, 1864, p. 596.—WALSINGHAM, Trans. Am. Ent. Soc. Phila., X, 1882, p. 178.—RILEY, Smith's List Lep. Bor. Am., No. 5506, 1891.
- Depressaria fuscochrella* CHAMBERS, Can. Ent., IV, 1872, pp. 106, 129, 147, 148.
- Gelechia fuscochrella* CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 143.
- Gelechia (Lita) liturosellu* ZELLER, Verh. k. k. zool.-bot. Gesell. Wien, XXIII, 1873, p. 265.—CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 144.

To Lord Walsingham is due the credit for the entire synonymy. I am indebted to him for his manuscript note that *mediofuscella* should be added to the already published synonymy, which the description also bears out.

It is a common species in the District of Columbia, which I have taken in numbers in very early spring (March, April), and again in July.

Its life history is unknown as yet, but a clew may be found in a specimen which issued, April 25, from old, dry cornstalks collected and placed in breeding case the previous fall. This specimen was perfect and seemingly fresh, but not having observed the larva, I am unable to say with certainty that it was not an overwintering moth or that the larva accidentally had found a convenient pupating place in the cornstalks.

GELECHIA WALSINGHAMI Dietz.

- Pseudochelaria walsinghami* DIETZ, Ent. News, XI, 1900, p. 352, pl. 1, fig. 3.
- Gelechia walsinghami* WALSINGHAM and DURRANT, Ent. Mo. Mag., XXXVIII, 1902, p. 28.—BUSCK, Dyar's List Amer. Lep., No. 5765, 1903.

Through the kindness of Dr. Dietz I have examined his types of this species and the National Museum possesses several cotypes. It is a typical *Gelechia*, which was placed by error in an unpublished manuscript genus of Lord Walsingham's, thereby spoiling the name *Pseudochelaria* for future application to the intended—to me unknown—genus.

Food plant.—*Rhus typhosa*.

Habitat.—Pennsylvania.

GELECHIA PENNSYLVANICA Dietz.

- Pseudochelaria pennsylvanica* DIETZ, Ent. News, XI, 1900, p. 353, pl. 1, fig. 4.—WALSINGHAM, Ent. Mo. Mag., XXXVIII, 1901, p. 29.
- Gelechia pennsylvanica* BUSCK, Dyar's List Amer. Lep., No. 5766, 1903.

As this species must be credited to Dr. Dietz it was proper that he

should describe it, and he has kindly handed me the following description of the moth which he figured.¹

Ashen gray, palpi with third joint longer than second, latter dark brownish at base externally, former dusted with fuscous, base and extreme apex white. Antennae faintly annulate with fuscous. Thorax with dark-brown spot posteriorly. Forewings marked with dark rich brown as follows: A trapezoidal space at base sharply limited externally by an oblique line nearer the base at the dorsal margin and slightly concave toward the apex. This space is separated from the costal margin by a pale area. An irregular stripe extends through the entire wing to apex, shading off gradually toward the costa. A transverse pale line at the beginning of the cilia, oblique in its dorsal half, concave toward the apex in its costal part. Apical part of wing with dark lines. Cilia gray with two dark lines. Posterior wings pale fuscous. Underside paler. Legs, except posterior pair, fuscous, annulated with black.

Alar expanse.—17 mm.

Habitat.—Hazleton, Pennsylvania.

Type.—In Dietz's collection.

Described from a single specimen taken at light. Closely allied to *Gelechia walsinghami* Dietz.

I have seen no other specimen of this species which, in my judgment, is a true *Gelechia*, and not what it was supposed to be, the type of *Pseudocheluria* Walsingham manuscript.

GELECHIA TEPHRIASELLA Chambers.

Gelechia tephriasella CHAMBERS, Can. Ent., IV, 1872, p. 68; Cinn. Quart. Journ. Sci., II, 1875, p. 253; Bull. U. S. Geol. Surv., IV, 1878, p. 147.—WALSINGHAM, Trans. Am. Ent. Soc. Phila., X, 1882, p. 181.—RILEY, Smith's List Lep. Bor. Am., No. 5490, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5767, 1903.

No authentic type of this species exists, but in the U. S. National Museum is a specimen which has on the pin one of Chambers' pill-box labels with *Gelechia tephriasella* in his handwriting. This specimen consists of only thorax and the two forewings, but these latter agree with Chambers' description and the specimen presumably truly represents this species.

While the genus can not be determined with certainty from these two forewings, the species appears to belong near the following, a probability which is strengthened by Chambers' description and his observation² that this species reminded him of *griseofusciella* (*conclusella* Walker).

However, the generic determination must stand only for what it is, liable to change through future evidence.

The venation in the forewings is normal 12 veins, 7 and 8 stalked, rest separate (not as in the following with veins 3 and 4 stalked). The peculiar coloration of the antennae described by Chambers should make recognition of this species easy.

Habitat.—Kentucky.

¹Ent. News, XI, pl. 1, fig. 4.

²Cinn. Quart. Journ., II, p. 253.

GELECHIA CONCLUDELLA Walker.

Gelechia conclusella WALKER, Cat. Lep. Het. Brit. Mus., XXIX, 1864, p. 593.—WALSINGHAM, Trans. Am. Ent. Soc. Phila., X, 1882, p. 179.—RILEY, Smith's List Lep. Bor. Am., No. 5341, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5768, 1903.

Gelechia grissefasciella CHAMBERS, Cinn. Quart. Journ. Sci., II, 1875, p. 253; Bull. U. S. Geol. Surv. IV, 1878, p. 144.

In the U. S. National Museum are several specimens labeled by Lord Walsingham, *Gelechia conclusella* Walker; these are identical with specimens thus named by Lord Walsingham in collections of Dr. Dietz, and in the Philadelphia Academy of Natural Sciences. They agree with Walker's description and evidently correctly represent his species.

They are the same as type no. 447, in the U. S. National Museum, of *Gelechia grissefasciella*, received with his label from Chambers, thus confirming the synonymy made by Walsingham. There is one other supposed "type" of *grissefasciella*, namely, in the Museum of Comparative Zoology, Cambridge, but this is an entirely different thing, an undescribed species of *Neolyda*, unhappily unfit for description; it does not, however, agree with Chambers' description, while U. S. National Museum type does, and the latter is evidently authentic.

Lord Walsingham also made *crecentifasciella* Chambers a synonym of *conclusella*, but this, as previously shown (p. 846), was done on faulty evidence, and *crecentifasciella* is a distinct species belonging to *Anacamptis*.

The present species has veins 3 and 4 in forewings stalked, and thereby differs from the most of the species in the genus in which it is placed. I am, however, at present not willing to differentiate it generically.

GELECHIA RILEYELLA Chambers.

Depressaria rileyella CHAMBERS, Can. Ent., IV, 1872, pp. 106, 129, 147, 148; Bull. U. S. Geol. Surv., IV, 1878, p. 138.—RILEY, Smith's List Lep. Bor. Am., No. 5277, 1891.

Gelechia rileyella RILEY, Smith's List Lep. Bor. Am., No. 5468.—BUSCK, Proc. U. S. Nat. Mus., XXIV, 1902, p. 732; Dyar's List Amer. Lep., No. 5769, 1903.

Type no. 462, in the U. S. National Museum, of *Depressaria rileyella*, bearing Chambers' handwritten label and the date 1872, is the same as three types found in the Museum of Comparative Zoology in Cambridge, also bearing Chambers' labels.

These types are all in very poor condition specifically, but prove conclusively that the species is a true *Gelechia*.

The type in the National Museum bears Lord Walsingham's blue label no. 1170, and there is also a better preserved specimen determined by Walsingham and bearing his blue label no. 1211.

Habitat.—Kentucky, Canada.

No other specimens are known to me.

GELECHIA NUNDINELLA Zeller.

Gelechia nundinella ZELLER, Verh. k. k. zool.-bot. Gesell. Wien, XXIII, 1873, p. 256.—CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 145.—RILEY, Smith's List Lep. Bor. Am., No. 5420, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5770, 1903.

Gelechia beneficentella MURTFELDT, Can. Ent., XIII, 1881, p. 245.—RILEY, Smith's List Lep. Bor. Am., No. 5321, 1891.

Zeller's type in the Cambridge Museum of *Gelechia nundinella* proves, as the description would indicate, that it is the same as Miss Murtfeldt's later-described *beneficentella*, of which good bred series are found in the U. S. National Museum, besides authentic specimen received from Miss Murtfeldt.

Food plant.—*Solanum carolinense*.

Habitat.—Missouri (Murtfeldt), Texas (Zeller, Boll), District of Columbia (Busck).

GELECHIA MONUMENTELLA Chambers.

Gelechia monumentella CHAMBERS, Bull. U. S. Geol. Surv., III, 1877, p. 125; U. S. Geol. Surv. Bull., IV, 1878, p. 145.—RILEY, Smith's List Lep. Bor. Am., No. 5413, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5771, 1903.

The unique type of this species is found in good condition in the Cambridge Museum, agreeing with the description, and labeled "Colorado," with the name in Chambers' handwriting.

The type shows one point not mentioned by Chambers, namely, a thin, indistinct, but complete white fascia at apical third.

In the U. S. National Museum there is a large series of this very distinct insect, bred by Mr. Coquillett and Mr. Koebele in California from *Fraxinus grandiflora*.

GELECHIA OBSCUROSUFFUSELLA Chambers.

Gelechia obscurosuffusella CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, pp. 90, 145.—RILEY, Smith's List Lep. Bor. Am., No. 5425, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5772, 1903.

Type no. 456, in the U. S. National Museum, of this species from Chambers agrees with other types examined in the Cambridge Museum and in Professor Fernald's collection. All are in rather poor condition, but agree so far as can be made out with Chambers' description and prove that the species is a true *Gelechia*.

I have met with no other specimens.

Habitat.—Texas.

GELECHIA PETASITIS Pfaffenzeller.

Gelechia petasitis PFAFFENZELLER, Stett. Ent. Zeit., XXVIII, 1867, p. 79.—STAUDINGER and REBEL, Cat. Lep. Eur., II, 1901, No. 2588.—WALSINGHAM, Trans. Am. Ent. Soc. Phila., X, 1882, p. 178.—RILEY, Smith's List Lep. Bor. Am., No. 5445, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5773, 1903.

I have examined in Professor Fernald's collection three specimens which Lord Walsingham determined as the European insect.

One of these, through the kindness of Professor Fernald, is now the property of U. S. National Museum. It agrees with Pfaffenzeller's description.

The European food plant is *Petasitis nirens*, on which the larva mines the leaves. Other species of *Petasitis*, on which the species may live, occur in this country.

GELECHIA PANELLA, new species.

Gelechia panella Busck, Dyar's List Amer. Lep., No. 5774, 1903.

Antennæ dark reddish fuscous, annulated with white. Labial palpi with well developed furrowed brush; second joint on the upper and inner side whitish, the outside and the brush deep purplish red. Face white with a reddish tint. Head, thorax, and forewings uniformly bright brick red; at the end of the cell is a very indistinct blackish dot and at apical third is a still more indistinct very narrow oblique yellowish white fascia across the wing. No other markings are found, and those mentioned are easily overlooked. Cilia reddish, sprinkled with white. Under side of forewings shining dark fuscous. Hindwings broader than forewings, light silvery fuscous, darker and yellowish toward apex. Cilia yellowish fuscous. Abdomen dark fuscous, underside ochreous. Forelegs reddish, posterior legs yellow sprinkled with black; tarsal joints blackish, slightly tipped with yellow.

Alar expanse.—20 mm.

Habitat.—Arizona, California.

Type.—No. 6391, U.S.N.M.

This striking species, which can not be confused with any other described American *Gelechia*, is described from two perfect specimens, one collected in Arizona by Mr. E. A. Schwarz and the other probably bred by Mr. Koebele at Los Angeles, California.

GELECHIA ABELLA, new species.

Gelechia abella Busck, Dyar's List Amer. Lep., No. 5775, 1903.

Antennæ silvery white sharply annulated with dark fuscous. Labial palpi with rather small brush pure silvery white. Face and head pure white. Thorax suffused with fuscous; forewings white but so thickly suffused with fuscous as to obliterate the white ground-color except on apical third of the wing, which is pure white. Near base is an ill-defined oblique costal streak with only a few dark scales therefore appearing whitish against the darker surrounding parts. Cilia white. Hindwings as broad as forewings, light fuscous. Abdomen yellowish fuscous. Legs gray with white bars on the outside.

Alar expanse.—15 mm.

Habitat.—Colorado.

Type.—No. 6392, U.S.N.M.

This species which, by its peculiar coloration, probably imitates bird-droppings can not be mistaken for any other described species and is at once recognized by its pure white head, palpi, and apical third of the forewings.

GELECHIA FUSCOTÆNIAELLA Chambers.

Gelechia fuscotæniaella CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, pp. 89, 143.—

BUSCK, Dyar's List Amer. Lep., No. 5776, 1903.

Gelechia fuscotæniella RILEY, Smith's List Lep. Bor. Am., No. 5374, 1891.

Gelechia fuscolinianella RILEY, Smith's List Lep. Bor. Am., No. 5370, 1891.

Type no. 451 in the U. S. National Museum of this species is labeled by Chambers *fuscotiniella*, which, through misreading, led Riley to include the name *fuscoleniella* in his list. This name consequently refers to the present species.

The type is identical with specimens in the Museum of Comparative Zoology in Cambridge, rightly labeled by Chambers. Both are in rather poor condition, but easily recognized from description by the pure white forewings with the sharply limited dark brown base.

The types are from Texas; in the National Museum there is also a better preserved specimen from Colorado.

B.—Unrecognized Species.

GELECHIA ADAPTERELLA Walker.

Gelechia adapterella WALKER, Cat. Lep. Het. Brit. Mus., XXIX, 1864, p. 590.—

BUSCK, Dyar's List Amer. Lep., No. 5778, 1903.

This species was omitted in Riley's list. The type should be examined in the British Museum. Habitat not given by Walker.

GELECHIA ALBISTRIGELLA Chambers.

Gelechia albistrigella CHAMBERS, Can. Ent., IV, 1872, p. 171.—HAGEN, Papilio, IV, 1884, p. 98.—RILEY, Smith's List Lep. Bor. Am., No. 5304, 1891.

BUSCK, Dyar's List Amer. Lep., No. 5779, 1903.

Two types of this species are in the Museum of Comparative Zoology in Cambridge, but in so poor condition that they can not be recognized with any degree of positiveness. They are, however, probably authentic, and remind one, as Chambers says, of *Strobisia*. As far as can be made out, without injuring the specimens, the forewings, which are obtusely rounded, have 11 veins, 8 coincident with 7, 3 and 4 stalked. Hindwings with 8 veins, 3 and 4 connate, 6 and 7 connate. Labial palpi with second joint considerably thickened with smoothly appressed scales, abruptly cut off at apex; terminal joint shorter than second joint.

However, it was so difficult to examine these specimens that I feel uncertain about the characters and must at present leave the species as unrecognized.

It is a rather striking insect and should easily be recognized from the description if found again.

Habitat.—Kentucky.

GELECHIA AMBROSICELLA Chambers.

Gelechia ambrosicella CHAMBERS, Cinn. Quart. Journ. Sci., II, 1875, p. 239; Bull. U. S. Geol. Surv., IV, 1878, p. 141.—RILEY, Smith's List Lep. Bor. Am., No. 5308, 1901.—BUSCK, Dyar's List Amer. Lep., No. 5780, 1902.

Chambers sent out to correspondents several specimens of a Tineid labeled: *Sinoë ambrosicella*, which he afterwards determined¹ as specimens of *Butalis matutella* Clemens. One of these was sent to U. S. National Museum, and when Riley made his List of 'Tineina he came across this specimen and recognizing Chambers' label, placed an asterisk by *ambrosicella* in his list, indicating that a specimen was found in the museum collection, without recognizing the faulty determination.

No types or recognized specimen of the present species are found in any of the collections, and I have failed to breed the species, although making several efforts. But the knowledge of the foodplant and larval habits [the larva feed according to Chambers in the fruits of *Ambrosia trifida*] together with the description insure ultimate rediscovery of the species, which Chambers thought very near to *Trichotuphe chambersella* Murtfeldt (p. 913).

GELECHIA AMORPHELLA Chambers.

Gelechia amorphella CHAMBERS, Bull. U. S. Geol. Surv., III, 1877, p. 124; IV, 1878, p. 141.—RILEY, Smith's List Lep. Bor. Am., No. 5309, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5781, 1902.

All authentic specimens of this species are lost, and I have not recognized it from the description in the material examined, but continued collecting and breeding in Colorado ought to enable recognition of the species, the food plant of which Chambers gave with some doubt as *Amorpha fruticosa*.

GELECHIA ANGUSTIPENNELLA Clemens.

Gelechia angustipennella CLEMENS, Proc. Ent. Soc. Phila., II, 1863, p. 119; Stainton Ed. N. Am. Tin., 1872, pp. 222, 224.—CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 141.—RILEY, Smith's List Lep. Bor. Am., No. 5311, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5782, 1902.

The type is lost and I have not recognized the species; the description gives no clew to the proper genus.

Habitat.—Pennsylvania?

¹Can. Ent., V, p. 231.

GELECHIA ARGENTIALBELLA Chambers.

Gelechia argentialbella CHAMBERS, Can. Ent., III, 1874, p. 241; Bull. U. S. Geol. Surv., IV, 1878, p. 141.—RILEY, Smith's List Lep. Bor. Am., No. 5313, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5783, 1902.

No authentic material exists of this species, which, according to Chambers, is very like *Recurvaria variella* Chambers [p. 809].

Habitat.—Texas.

GELECHIA ATTRITELLA Walker.

Gelechia attritella WALKER, Cat. Brit. Mus., XXIX, 1864, p. 592.—BUSCK, Dyar's List Amer. Lep., No. 5784, 1902.

The type of this species should be examined in British Museum. The description gives no clew to the proper genus.

Habitat.—Not given.

GELECHIA DISCOMACULELLA Chambers.

Gelechia discomaculella CHAMBERS, Can. Ent., IV, 1872, p. 172; Cinn. Quart. Journ. Sci., II, 1875, p. 239; Bull. U. S. Geol. Surv., IV, 1878, p. 143.—RILEY, Smith's List Lep. Bor. Am., No. 5353, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5785, 1902.

Gelechia aurimaculella CHAMBERS, Can. Ent., IV, 1872, p. 172; Bull. U. S. Geol. Surv., IV, 1878, p. 141.—RILEY, Smith's List Lep. Bor. Am., No. 5316, 1891.

According to Miss Murtfeldt and Lord Walsingham the above synonymy is correct, but no authentic specimens of either species are now preserved. The descriptions read very much alike. According to Chambers this species is "difficult to distinguish from *Gelechia marmorella* Chambers,¹ even on comparison of specimens."

GELECHIA BADIOMACULELLA Chambers.

Gelechia badiomaculella CHAMBERS, Can. Ent., IV, 1872, p. 192; Bull. U. S. Geol. Surv., IV, 1878, p. 141.—RILEY, Smith's List Lep. Bor. Am., No. 5317, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5786, 1902.

Described from a single specimen taken under a gaslight and with the palpi [at least!] burned. A yellowish and brown species with tufted wings, which will be difficult ever to rediscover with certainty, as it may not even belong to the family Gelechiidae.

Habitat.—Kentucky.

GELECHIA BISTRIGELLA Chambers.

Depressaria bistrigella CHAMBERS, Can. Ent., IV, 1872, pp. 92, 128, 147.

Gelechia bistrigella CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 142.—RILEY, Smith's List Lep. Bor. Am., No. 5328, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5787, 1902.

Nothing can be said about the proper genus of this species from the description. Type is lost.

Habitat.—Canada.

¹*Phthorimza marmorella*, p. 823.

GELECHIA BRUMELLA Clemens.

Gelechia brumella CLEMENS, Proc. Ent. Soc. Phila., II, 1864, p. 416; Stainton Ed. N. Am. Tin., p. 239, 1872.—CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 142.—RILEY, Smith's List Lep. Bor. Am., No. 5330, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5788, 1902.

Described from a single somewhat denuded specimen from Labrador, which is no longer in existence.

GELECHIA CANOPULVELLA Chambers.

Gelechia canopulvella CHAMBERS, Bull. U. S. Geol. Surv., 1878, pp. 91, 142.—RILEY, Smith's List Lep. Bor. Am., No. 5332, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5789, 1902.

Of this species the unique type is still in the Museum of Comparative Zoology in Cambridge, but it is in so poor a condition that definite recognition is not possible at the present time. It is, however, without doubt a true *Gelechia*, near, if not the same as *Gelechia obscurousuffusella* Chambers [p. 888].

Habitat.—Texas.

GELECHIA CAPITEOCHRELLA Chambers.

Gelechia capiteochrella CHAMBERS, Conn. Quart. Journ. Sci., II, 1875, p. 252; U. S. Geol. Surv. Bull., IV, p. 142.—RILEY, Smith's List Lep. Bor. Am., No. 5333, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5790, 1902.

Can not be placed from description; type is lost; no locality given.

GELECHIA CARYÆVORELLA Packard.

Gelechia caryævorella PACKARD, Rept. U. S. Dept. of Agric., 1885, p. 331, 1886; Rept. U. S. Ent. Comm., V, 1890, p. 314.—RILEY, Smith's List Lep. Bor. Am., No. 5333a, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5791, 1902.

From the knowledge of the larva and the description of the imago it should not be difficult ultimately to rediscover this species, type of which is lost.

According to Professor Fernald it is allied to *Gelechia bicostomuculella* Chambers, and it may prove on discovery to be synonymous with one of the several similar species of that group.

Habitat.—Rhode Island.

GELECHIA CASSELLA Walker.

Gelechia cassella WALKER, Cat. Brit. Mus., XXIX, 1864, p. 594.—RILEY, Smith's List Lep. Bor. Am., No. 5333b, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5799, 1902.

The type of this species should be examined in British Museum. The description gives no clew to its proper genetic position.

Exact habitat not given.

GELECHIA DECEMMACULELLA Chambers.

Gelechia decemmaculella CHAMBERS, Cinn. Quart. Journ. Sci., II, 1875, p. 290; Bull. U. S. Geol. Surv., III, 1877, p. 128; IV, 1878, p. 142.—RILEY, Smith's List Lep. Bor. Am., No. 5349, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5793, 1902.

Described from a single captured specimen which is now lost. According to Chambers, "it reminds one in ornamentation of *Gelechia difficilisella* Chambers [*Epithectis attributella* Walker p. 817], but is a larger insect with hindwings not excised beneath the tip."

Habitat.—Colorado.

GELECHIA BRACKENRIDGIELLA Busck.

Gelechia detersella CLEMENS (not Zeller), Proc. Acad. Nat. Sci. Phila., 1860, p. 164; Stainton Ed. N. Am. Tin., 1872, pp. 40, 116, 225.—CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 142.—RILEY, Smith's List Lep. Bor. Am., No. 5351, 1891.

Gelechia brackenridgiella BUSCK, Dyar's List Amer. Lep., No. 5794, 1902.

Cotypes of this species should be examined in British Museum, where the two specimens sent to Stainton by Clemens in 1860 presumably are found.

Stainton thought it allied to the European *Gelechia affinis* Douglas.¹

No types exist in this country of this species, which may be known under the above name instead of the preoccupied name *detersella*.

GELECHIA DISCOANULELLA Chambers.

Gelechia discoanulella CHAMBERS, Cinn. Quart. Journ. Sci., II, 1875, p. 254; Bull. U. S. Geol. Surv., IV, 1878, p. 143.—BUSCK, Dyar's List Amer. Lep., No. 5795, 1902.

Gelechia discoanulella RILEY, Smith's List Lep. Bor. Am., No. 5352, 1891.

According to Chambers, a pale ochreous species with dark, annulated spot at the end of the cell on forewings.

No type exists. No locality given.

GELECHIA DISCOSTRIGELLA Chambers.

Gelechia discostrigella CHAMBERS, Cinn. Quart. Journ. Sci., II, 1875, p. 248; Bull. U. S. Geol. Surv., IV, 1878, p. 143.—RILEY, Smith's List Lep. Bor. Am., No. 5356, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5796, 1902.

Described from a single type with palpi missing. This unique type is still preserved in the Museum of Comparative Zoology in Cambridge, but now lacks, besides the palpi, part of all the wings, and it is in such condition as to prohibit generic recognition.

The type shows the species to be a large, broad-shouldered insect, with basal half of forewings white and extreme base blackish brown.

Habitat.—California.

¹*Bryotropha affinis* Staudinger and Rebel, Cat. Lep. Eur., No. 2531, 1901.

GELECHIA FLAVICORPORELLA Walsingham.

Gelechia flavicorporella WALSHINGHAM, Trans. Am. Ent. Soc. Phila., X, 1882, p. 177.—RILEY, Smith's List Lep. Bor. Am., No. 5361, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5797, 1902.

Of this species two types are found in Professor Fernald's collection, but by accident I lost my notes on them and am at present unable to recognize the species.

It is, however, probably a true *Gelechia*.

GELECHIA FLEXURELLA Clemens.

Gelechia flexurella CLEMENS, Proc. Acad. Nat. Sci. Phila., 1860, p. 163; Proc. Ent. Soc. Phila., II, 1863, p. 122; Stainton Ed. N. Am. Tin., 1872, pp. 115, 225.—CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 143.—RILEY, Smith's List Lep. Bor. Am., No. 5363, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5798, 1902.

Type is lost; from Clemens's description I would suppose that this species probably belongs to the genus *Aristotelia*.

Habitat.—Pennsylvania

GELECHIA FUSCOLUTEELLA Chambers.

Depressaria fuscoluteella CHAMBERS, Can. Ent., IV, 1872, pp. 106, 147.
Gelechia fuscoluteella CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 143.—RILEY, Smith's List Lep. Bor. Am., No. 5368, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5799, 1902

No authentic specimens exist, and the short description is insufficient for recognition.

Habitat.—Kentucky.

GELECHIA FUSCOMACULELLA Chambers.

Gelechia fuscomaculella CHAMBERS, Can. Ent., IV, 1872, p. 170; Bull. U. S. Geol. Surv., IV, 1878, p. 143.—RILEY, Smith's List Lep. Bor. Am., No. 5369, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5800, 1902.

The unique type of this species in the Museum of Comparative Zoology in Cambridge is in very poor condition, with one forewing and part of the other and of both hindwings gone.

It is impossible to place it with certainty, but I believe it is a true *Gelechia*.

Habitat.—Kentucky.

GELECHIA FUSCOPUNCTELLA Clemens.

Gelechia fuscopunctella CLEMENS, Proc. Ent. Soc. Phila., II, 1863, pp. 12, 121; Stainton Ed. N. Am. Tin., 1872, pp. 218, 225.—CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 143.—RILEY, Smith's List Lep. Bor. Am., No. 5373, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5801, 1902.

Type is lost and description insufficient for certain generic determination.

Habitat.—Pennsylvania?

GELECHIA GILVOMACULELLA Clemens.

Gelechia gilvumaculella CLEMENS, Proc. Ent. Soc. Phila., 1863, II, pp. 12, 121; Stainton Ed. N. Am. Tin., 1872, pp. 218, 225.—CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 144.—RILEY, Smith's List Lep. Bor. Am., No. 5381, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5802, 1902.

The type is lost and description insufficient for generic determination.
Habitat.—Pennsylvania?

GELECHIA GLYCYRIZÆELLA Chambers.

Gelechia glycyrizæella CHAMBERS, Bull. U. S. Geol. Surv., III, 1877, p. 124 —BUSCK, Dyar's List Amer. Lep., No. 5803, 1902.
Gelechia glycyrizæella CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 144.—RILEY, Smith's List Lep. Bor. Am., No. 5384, 1891.

The unique type of this species is in rather well-preserved condition in the Museum of Comparative Zoology in Cambridge. But I have not been able to find another specimen exactly like it in any of the collections, and as I can not with absolute certainty make out the genus of the type specimen without injuring it, I prefer, therefore, to postpone definite determination of the species until more material is at hand. It is probably a true *Gelechia*. Food plant was given with some doubt by Chambers as *Glycyrrhiza lepidota*.

Habitat.—Colorado.

GELECHIA GRISELLA Chambers.

Gelechia grisella CHAMBERS, Can. Ent., IV, 1872, p. 171; Bull. U. S. Geol. Surv., IV, 1878, p. 144.—RILEY, Smith's List Lep. Bor. Am., No. 5385, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5804, 1902.

The type is lost and the description is insufficient for generic determination.

Habitat.—Kentucky.

GELECHIA GRISEÆELLA Chambers.

Parasia griseæella CHAMBERS, Can. Ent., 1872, IV, p. 88.
Gelechia griseæella CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 144.—RILEY, Smith's List Lep. Bor. Am., No. 5386, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5805, 1902.

The type is lost and the description insufficient for generic determination.

Habitat.—Canada.

GELECHIA GRISEOCHRELLA Chambers.

Gelechia griseochrella CHAMBERS, Cinn. Quart. Jour. Sci., II, 1875, p. 247; Bull. U. S. Geol. Surv., IV, 1878, p. 144.—RILEY, Smith's List Lep. Bor. Am., No. 5387, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5806, 1902.

The type is lost. From Chambers' description and his comparison of the venation with that of *Callima argenticinctella* Clemens, it seems

highly probable that this species does not even belong in the family Gelechiidae. However, as it can not at present be placed elsewhere it must remain under the present genus until recognized.

Habitat.—California.

GELECHIA LABRADORICA Moeschler.

Gelechia labradorica MOESCHLER, Wien. Ent. Monatsch., 1864, p. 200.—GROTE, Can. Ent., IV, 1872, p. 125.—CHAMBERS, Bull. U. S. Geol. Surv., IV, p. 144, 1878.—RILEY, Smith's List Lep. Bor. Am., No. 5395, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5807, 1902.

Presumably a true *Gelechia*, but which can not be definitely placed from the description.

Habitat.—Labrador.

GELECHIA LABRADORIELLA Clemens.

Gelechia labradoriella CLEMENS, Proc. Ent. Soc. Phila., II, 1863, pp. 12, 120; Stainton Ed. N. Am. Tin., 1872, pp. 220, 224, 239.—CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 144.—RILEY, Smith's List Lep. Bor. Am., No. 5396, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5808, 1902.

? *Gelechia viduella* FABRICIUS, Staudinger & Rebel, Cat. Lep. Eur., II, No. 2618. 1901.

Placed by Staudinger and Rebel as a synonym of the European *Gelechia viduella* Fabricius, with a question mark. No authentic material of Clemens' is left, but the evidently rather striking species should be recognized from the description when fuller collections from Labrador are obtained.

GELECHIA LACTEUSOCHRELLA Chambers.

Gelechia lacteusochrella CHAMBERS, Cinn. Quart. Journ. Sci., II, 1875, p. 244; Bull. U. S. Geol. Surv., IV, 1878, p. 144.—RILEY, Smith's List Lep. Bor. Am., No. 5397, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5810, 1902.

The type of this species is lost and the description gives no evidence of the true generic position of the species.

Habitat.—California.

GELECHIA LITURELLA Walker.

Gelechia liturella WALKER, Cat. Brit. Mus., XXIX, 1864, p. 591.—BUSCK, Dyar's List Amer. Lep., No. 5811, 1902.

Type should be examined in British Museum.

GELCHIA MACULATUSELLA Chambers.

Gelechia maculatusella CHAMBERS, Cinn. Quart. Journ. Sci., II, 1875, p. 245; Bull. U. S. Geol. Surv., IV, 1878, p. 144.—RILEY, Smith's List Lep. Bor. Am., No. 5404, 1891.—BUSCK, Dyar's List Amer. Lep., 5812, 1902.

The type is lost and the description is insufficient for generic determination.

Habitat.—California.

GELECHIA MILLERIELLA Chambers.

Gelechia milleriella CHAMBERS, Cinn. Quart. Journ. Sci., II, 1875, p. 253; Bull. U. S. Geol. Surv., IV, 1878, p. 144.—RILEY, Smith's List Lep. Bor. Am., No. 5408, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5813, 1902.

The type is lost and description insufficient for generic determination.
Habitat.—Not given.

GELECHIA MIMELLA Clemens.

Gelechia mimella CLEMENS, Proc. Acad. Nat. Sci., Phila., 1860, p. 163; Proc. Ent. Soc. Phila., II, 1863, p. 121; Stainton Ed. N. Am. Tin., 1872, pp. 116, 225.—CHAMBERS, Can. Ent., IV, 1872, p. 69; Bull. U. S. Geol. Surv., IV, 1878, p. 145.—RILEY, Smith's List Lep. Bor. Am., No. 5409, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5814, 1902.

The type of the species is lost; Chambers thought it similar or possibly even synonymous with his *Gelechia palpiannulella* (*Aristotelia absconditella*, Walker, p. 801), but Clemens expressly said in his synoptic table of his species of *Gelechia* that *mimella* has hindwings with rounded apex, not produced, and it can consequently not be looked for in *Aristotelia*.

Habitat.—Pennsylvania?

GELECHIA OBSCURELLA Chambers.

Gelechia obscurella CHAMBERS, Can. Ent., IV., 1872, p. 170; Bull. U. S. Geol. Surv., IV, 1878, p. 145.—RILEY, Smith's List Lep. Bor. Am., No. 5423, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5815, 1902.

In the Cambridge Museum is found a type of this species, which shows it to be a true *Gelechia* similar to, but different from, *Gelechia monumentella* Chambers [p. 888]. Chambers himself thought it similar to the following unrecognized species. The type is, however, in so poor condition that I have not been able to identify it specifically with certainty, and much fuller collections should be made in Chambers' old hunting grounds in Kentucky before definite determination is attempted.

GELECHIA OBSCURUSELLA Chambers.

Depressaria obscurusella CHAMBERS, Can. Ent., 1872, pp. 106, 129, 148; Bull. U. S. Geol. Surv., IV, p. 145.—RILEY, Smith's List Lep. Bor. Am., No. 5426, 1891.—BUSCK, Dyer's List Amer. Lep., No. 5816, 1902.

Gelechia fuscopulvella CHAMBERS, Can. Ent., IV, 1872, p. 170; Cinn. Quart. Journ. Sci., II, 1875, p. 245; Bull. U. S. Geol. Surv., IV, 1878, p. 143.—RILEY, Smith's List Lep. Bor. Am., No. 5372, 1891.

Types of both the above species are found in the Cambridge Museum, but in nearly useless condition. They seem, however, absolutely identical so far as comparison is possible, and, as the two descriptions also agree, I have no hesitation in uniting them. The species is probably a

true *Gelechia* and possibly the same as the foregoing species, though I think I am able to differentiate the two excuses for types.

Habitat.—Kentucky. Canada.

GELECHIA OCHERFUSCELLA Chambers.

Gelechia ocherfussella CHAMBERS, Cinn. Quart. Journ. Sci., II, 1875, p. 249.—BUSCK, Dyar's List Amer. Lep., No. 5817, 1902.

Gelechia ochreofussella CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 145.—RILEY, Smith's List Lep. Bor. Am., No. 5429, 1891.

Described from a single specimen without palpi, which is now lost. Nothing can be said from the description about the generic position of the species.

Habitat.—California.

GELECHIA ORNATIFIMBRIELLA Clemens.

Gelechia? ornatifimbriella CLEMENS, Proc. Ent. Soc. Phil., II, 1864, p. 420; Stainton Ed. N. Am. Tin., 1872, p. 242.—CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 145.—RILEY, Smith's List Lep. Bor. Am., No. 5435.—BUSCK, Dyar's List Amer. Lep., No. 5818, 1902.

The types of this species are lost, and Clemens thought it an aberrant from approaching *Depressaria*. As far as his description of the venation and palpi is concerned it fits the present genus, but I have not identified it specifically.

Habitat.—Illinois.

GELECHIA PALLIDAGRISSELLA Chambers.

Gelechia pallidagrisella CHAMBERS, Can. Ent., VI, 1874, p. 237.—BUSCK, Dyar's List Amer. Lep., No. 5819, 1902.

Gelechia pallidagrisella CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 145.—RILEY, Smith's List Lep. Bor. Am., No. 5438.

The type is lost. Nothing can be gleaned from the description about the generic position of the species.

Habitat.—Texas.

GELECHIA PALPIALBELLA Chambers.

Gelechia palpialbella CHAMBERS, Cinn. Quart. Journ. Sci., II, 1878, p. 253; Bull. U. S. Geol. Surv., IV, 1878, p. 145.—BUSCK, Dyar's List Amer. Lep., No. 5820, 1902.

Gelechia palpialbella RILEY, Smith's List Lep. Bor. Am., No. 5441, 1891.

The type of the species is lost and the description insufficient for correct generic determination. Chambers said it is mistakable for *Gelechia (Aristotelia) physaliella* Chambers [p. 802].

No habitat is given.

GELECHIA PARVIPULVELLA Chambers.

Gelechia parvipulvella CHAMBERS, Can. Ent., VI, 1874, p. 242; Bull. U. S. Geol. Surv., IV, 1878, p. 145.—RILEY, Smith's List Lep. Bor. Am., No. 5443, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5821, 1902.

The type of the species is lost.

The following is a rather extreme but by no means unique example of some of Chambers' descriptions, which will serve to illustrate the difficulties connected with recognizing some of his species of which his types are lost, especially when it is borne in mind, that there is no assurance that the insects he placed under *Gelechia* belongs to the family *Gelechiidae* even:

Palpi simple. Pale yellowish white, lightly dusted with fuscous, the dusting more dense toward the apex of the primaries. Al. exp. $\frac{3}{4}$ inch. Season, May and August. Possibly a variety of *G. subalbusella*.

The description of *Gelechia subalbusella* is still more laconic and reads in full:

Second joint of the palpi not thickened. Creamy white, sparsely dusted with ochreous yellow and brown.

Habitat.—Texas.

GELECHIA PULLIFIMBRIELLA Clemens.

Gelechia pullifimbriella CLEMENS, Proc. Ent. Soc. Phila., II, 1863, p. 120; Stainton Ed. N. Am. Tin., 1872, pp. 223, 225.—CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 146.—RILEY, Smith's List Lep. Bor. Am., No. 5455, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5822, 1902.

Type is lost and description is insufficient for generic determination of the species.

Habitat.—Pennsylvania?

GELECHIA PULLUSELLA Chambers.

Gelechia pullusella CHAMBERS, Can. Ent., VI, 1874, p. 237; Bull. U. S. Geol. Surv., IV, 1878, p. 146.—RILEY, Smith's List Lep. Bor. Am., No. 5456; BUSCK, Dyar's List Amer. Lep., No. 5823, 1902.

The type is lost and the description is insufficient for determination.

Habitat.—Texas.

GELECHIA PUNCTIFERELLA Clemens.

Gelechia punctiferella CLEMENS, Proc. Ent. Soc. Phila., II, 1864, p. 119; Stainton Ed. N. Am. Tin., 1872, pp. 222, 224.—CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 146.—RILEY, Smith's List Lep. Bor. Am., No. 5457, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5824, 1902.

The type is lost and the description is insufficient for final generic determination.

Habitat.—Pennsylvania?

GELECHIA SIMPLICIELLA Chambers.

Gelechia simplicella CHAMBERS, Conn. Quart. Journ. Sci., II, 1875, p. 238; Bull. U. S. Geol. Surv., IV, 1878, p. 147.—RILEY, Smith's List Lep. Bor. Am., No. 5483, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5825, 1902.

The type is lost and definite determination of the species impossible from the description.

Chambers says it has some resemblance to a worn specimen of *Gelechia solaniella* Chambers (*Phthorimæa glochinella*, Zeller, p. 822).
Habitat.—Kentucky.

GELECHIA SUBALBUSELLA Chambers.

Gelechia subalbusella CHAMBERS, Can. Ent., VI, 1874, p. 242.—RILEY, Smith's List Lep. Bor. Am., No. 5485.—BUSCK, Dyar's List Amer. Lep., No. 5826, 1902.

Type is lost and nothing definite can be said concerning the proper genus of the species from the description.

Habitat.—Texas.

GELECHIA SUFFUSELLA Chambers.

Gelechia suffusella CHAMBERS, Can. Ent., IV, 1872, p. 171; Bull. U. S. Geol. Surv., IV, 1878, p. 147.—RILEY, Smith's List Lep. Bor. Am., No. 5488, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5827, 1902.

The six specimens supposed to be types of the species, placed as such in the Cambridge Museum and recorded by Hagen,¹ were found on examination to be specimens of *Gelechia rufusella* Chambers (*Anacamptis fullonella*, p. 849), and thus labeled by Chambers.

No types of *suffusella* exist, and nothing can be said from the description about the generic position of that species.

Habitat.—Kentucky.

GELECHIA THORACEOCHRELLA Chambers.

Gelechia thoraceochrella CHAMBERS, Can. Ent., IV, 1872, p. 169; Bull. U. S. Geol. Surv., IV, 1878, p. 147.—RILEY, Smith's List Lep. Bor. Am., No. 5493.—BUSCK, Dyar's List Am. Lep., No. 5828, 1902.

No types are found and description is insufficient for definite generic determination.

Habitat.—Kentucky.

GELECHIA THORACESTRIGELLA Chambers.

Gelechia thoracestrigella CHAMBERS, Cinn. Quart. Journ. Sci., II, 1875, p. 245; Bull. U. S. Geol. Surv., IV, 1878, p. 147.—RILEY, Smith's List Lep. Bor. Am., No. 5496, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5829, 1902.

No types are in existence.

Chambers says about this and about the foregoing species, as well as about *thoracealbella* (p. 867), that they are very similar to *Gelechia fuscopulvella*. Probably they are all like *thoracealbella*, true *Gelechia*.

Habitat.—California.

GELECHIA UNISTRIGELLA Chambers.

Gelechia unistrigella CHAMBERS, Can. Ent., V, 1873, p. 176.—RILEY, Smith's List Lep. Bor. Am., No. 5504, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5831, 1902.

Type is lost. The species can not be definitely determined generically from the description.

Habitat.—Kentucky.

¹ Papilio, IV, p. 99.

GELECHIA VERSICOLELLA Chambers.

Depressaria versicolorella CHAMBERS, Can. Ent., IV, 1872, pp. 127, 129, 148; Bull. U. S. Geol. Surv., IV, 1872, p. 138.—RILEY, Smith's List Lep. Bor. Am., No. 5284, 1891.

Gelechia versicolorella RILEY, Smith's List Lep. Bor. Am., No. 5509, 1891.—BUSCK, Proc. U. S. Nat. Mus., XXIV, 1902, p. 732; Dyar's List Amer. Lep., No. 5832, 1902.

As shown by me, this species must be a Gelechiid, but definite determination of the genus can not be obtained from the description. Type is lost.

Habitat.—Kentucky.

GELECHIA WACOELLA Chambers.

Gelechia wacoella CHAMBERS, Can. Ent., VI, 1874, p. 237; Bull. U. S. Geol. Surv., IV, 1878, p. 148.—RILEY, Smith's List Lep. Bor. Am., No. 5511, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5833, 1902.

Type is lost and exact generic determination is impossible from the description alone.

Habitat.—Texas.

MENESTA Clemens.

Plate XXXI, fig. 30.

Menesta CLEMENS, Proc. Ent. Soc. Phila., 1860, p. 213.

Hyale CHAMBERS, Cin. Quart. Jn. Sci., II, 1875, p. 242.

The characters of this genus in accordance with Clemens's description and verified by an undoubted specimen of the type of the genus are as follows: Labial palpi smooth, slender, curved, ascending, reaching vertex; second joint slightly thickened toward apex, terminal shorter than second, smooth, slender, pointed. Forewing short, broad, tortricid-formed apical edge nearly perpendicular on costal and dorsal edge; 10 veins, veins 4 and 8 absent, all separate, 7 to apex. Hindwings over I., 7 veins, 5 absent, 3 and 4 connate, 6 and 7 stalked.

Lord Walsingham's suggestion¹ that this genus is hardly rightly separated from *Stenomima* Zeller is far from right. Neither is his conception of the venation clear. In the article just referred to in his tabulation of the supposed allied genera he writes that veins 7 and 8 in forewing are separate, and he further says² that *Menesta cinerocervina* Walsingham, the venation of which he gives, differs in venation from the genus only in having veins 6 and 7 in hindwing connate instead of stalked, thus inferring that *Menesta*, like this species, has 11 veins in forewing and 8 in hindwing, while in reality it has only 10 and 7, respectively.

Chambers suggested and Lord Walsingham established the synonymy *Menesta* Clemens-*Hyale* Chambers, about which there can not be any doubt.

¹Insect Life, II, p. 154.

²Proc. Lond. Zool. Soc., 1895, p. 85.

The genus is an interesting one, related to *Strobisia* Clemens, and probably confined to America.

The three species at present known have all the same venation and are of great general resemblance, but easily separated by the different striking white markings.

With white costal spot.....	<i>melanella</i> , p. 903
Without costal spot.....	1
With apical cilia white.....	<i>albaciliella</i> , p. 903
Apical cilia not white.....	<i>tortriciformella</i> , p. 903

MENESTA TORTRICIFORMELLA Clemens.

Menesta tortriciformella CLEMENS, Proc. Acad. Nat. Sci. Phila., 1860, p. 213; Stainton Ed. Tin. N. Am., 1872, p. 151.—CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 150.—WALSINGHAM, Proc. Zool. Soc. Lond., 1881, p. 319; Insect Life, II, 1889, p. 154.—RILEY, Smith's List Lep. Bor. Am., No. 5227, 1891.—BUSCK, Dyar's List. Am. Lep., No. 5650, 1902.

Gelechia liturella WALKER, Cat. Lep. Brit. Mus., XXIX, 1864, p. 591.

Hyale coryliella CHAMBERS, Cinn. Quart. Journ. Sci., II, p. 242; Bull. U. S. Geol. Surv., IV, 1878, p. 157.

Gelechia coryliella PACKARD, Rep. U. S. Ent. Comm., V, 1890, p. 635.

Chambers' interesting life history of this species on hazel is quite similar to Miss Murtfeldt's excellent observations on the following species, *melanella* Murtfeldt, on oak, and further confirms the identity of *Hyale* and *Menesta*.

This species is probably local and is not common.

The specimen in the U. S. National Museum is from Massachusetts. Clemens' type presumably came from Pennsylvania, and Chambers described the species from Kentucky.

MENESTA MELANELLA Murtfeldt.

Menesta melanella MURTFELDT, Insect Life, II, 1890, p. 304.—RILEY, Smith's List Lep. Bor. Am., No. 5228, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5651, 1902.

This easily recognized species is well described by Miss Murtfeldt, and the interesting life history is carefully recorded with figure.

Food plant.—Oak.

Habitat.—Missouri.

A cotype and good bred series from Miss Murtfeldt are in the U. S. National Museum.

MENESTA ALBACILIÆELLA Chambers.

Strobisia albaciliæella CHAMBERS, Can. Ent., X, 1878, p. 77; Bull. U. S. Geol. Surv., IV, 1878, p. 162.—RILEY, Smith's List Lep. Bor. Am., No. 5580, 1891.

Menesta albaciliæella BUSCK, Dyar's List Amer. Lep., No. 5652, 1902.

This strikingly beautiful insect was described from a single specimen from Cincinnati. This unique type is found in easily recognizable condition in the Cambridge Museum, where I had an opportunity

to examine it. It bears Chambers' handwriting on the label, "*Strobisia albiciliella* Cham.," and it is undoubtedly authentic.

It is clearly a *Menesta*, agreeing perfectly in venation and palpi with this genus, and is very closely related to the two other species in the genus, but is at once distinguished by the white apical cilia in forewing, which contrasts beautifully with the very dark shining wing. I have only seen one other specimen of this fine species, namely, in Mr. Kearfott's collection, where is found a well-preserved specimen collected by him in New Jersey, on June 17.

STROBISIA Clemens.

Plate XXXI, fig. 31-32.

Strobisia CLEMENS, Proc. Acad. Nat. Sci. Phila., 1860, p. 164.

This genus is well characterized by Clemens, and has the following characters:

Labial palpi perfectly smooth, curved, slender; second joint scarcely thickened, terminal joint as long as second, pointed. Forewing elongate ovate, apex obtusely pointed; 12 veins, 7 and 8 stalked, or 11 veins, 7 and 8 coincident, 2 and 3 stalked. Hindwings narrower than forewing, apex obtuse, termen slightly sinuate; 8 veins, 3 and 4 connate, 5 parallel, 6 and 7 connate. The species have dark hindwings and brilliant iridescent markings on forewings. The genus is nearly related to *Trichotaphe* Clemens.

Two species hitherto placed in this genus I have transferred to other genera, namely, *levipedeella* Clemens, which belongs to *Anacampsis*, near *tristrigella* Walsingham, and will be found treated under that genus (p. 844), and *albaciliella* Chambers, which belongs to and will be found treated under *Menesta*.

The name *argenticiliella* Chambers as found in Chambers' "Index," p. 162, and in Smith's check list, No. 5581, does not appear to correspond to any description. The reference given in "Index"¹ is not correct, and the name must be dropped.

Only two described species are at present referable to this genus. They may be separated thus:

Metallic markings, narrow dashes and dots.....*irridipennella*, p. 904
Metallic markings, broad spots and bands*emblemella*, p. 905

STROBISIA IRRIDIPENNELLA Clemens.

Strobisia irridipennella CLEMENS, Proc. Acad. Nat. Sci. Phila., 1860, p. 165; Stainton Ed. N. Am. Tin, 1872, pp. 40, 118.—CHAMBERS, Can. Ent., IV, 1872, p. 89; Bull. U. S. Geol. Surv., IV, 1878, p. 162.—FREY, Stett. Ent. Zeit., XXXIX, 1878, p. 251.—RILEY, Smith's List Lep. Bor. Am., No. 5583, 1891.—DIERZ, Smith's List Ins. New Jersey, p. 474, 1900.—BUSCK, Dyar's List Amer. Lep., No. 5653, 1902.

¹Can. Ent., X.

Strobisia aphroditeella CHAMBERS, Can. Ent., IV, 1872, p. 88.—FREY, Stett. Ent. Zeit., XXXIX, 1878, p. 251.

Strobisia proserpinella FREY, Stett. Ent. Zeit., XXXIX, 1878, p. 251.—RILEY, Smith's List Lep. Bor. Am., No. 5585, 1891.

This species is the type of the genus and the more specialized of the two species. It has veins 7 and 8 in the forewings coincident.

Chambers is himself responsible for placing his *aphroditeella* as a synonym of *irridipennella*, which the description indicates is the case. He committed, however, a clerical mistake in doing it. He wrote:¹

Strobisia venustella I am now satisfied is a synonym of *S. irridipennella* Clemens. Because of the presence of several brilliant blue spots on the wings of my specimens not mentioned in Dr. Clemens' description, I was led to believe that they belonged to a different species. But the individuals vary in this respect.

There can be no question but that *venustella* is a mistake for *aphroditeella*, the description of which only can be applied to *irridipennella*. This is also demonstrated by Chambers afterwards in his "Index,"² where he placed his species right, *aphroditeella* as synonym of *irridipennella* and *venustella* as synonym of the following species, *emblemella* Clemens.

On account of the same defects in Clemens' description, which misled Chambers, Frey described his *proserpinella*, which undoubtedly is the same as *irridipennella*, the description agreeing in every particular.

Although this species is very abundant in the vicinity of Washington, and though I have given special attention to it for some years, its larval history is as yet entirely unknown, and furnishes a worthy subject for study for any student who has an opportunity to work it out. The larva will, I believe, be found to be a stem borer.

STROBISIA EMBLEMELLA Clemens.

Strobisia emblemella CLEMENS, Proc. Acad. Nat. Sci. Phila., 1860, p. 164; Stainton Ed. N. Am. Tin., 1872, pp. 40, 118.—CHAMBERS, Can. Ent., IV, 1872, pp. 89, 90; Bull. U. S. Geol. Surv., IV, 1878, p. 162.—FREY, Stett. Ent. Zeitung, XXXIX, 1878, p. 251.—RILEY, Smith's List Lep. Bor. Am., No. 5583, 1891.—DIETZ, Smith's List Ins. N. J., 1900, p. 474.—BUSCK, Dyar's List Amer. Lep., No. 5654, 1902.

Strobisia venustella CHAMBERS, Can. Ent., IV., 1872, p. 90.

This well-described species differs generically from the type only by having vein 8 in forewings present, out of vein 7. A specimen determined by Lord Walsingham and by the writer are in the U. S. National Museum.

It is not nearly as common in the localities around Washington as the preceding species.

¹ Can. Ent., VI, p. 7.

² U. S. Geol. Surv. Bull., IV, p. 162.

TRICHOTAPHE Clemens.

Plate XXXII, fig. 33.

Trichotaphe CLEMENS, Proc. Acad. Nat. Sci. Phila., 1860, p. 166.*Begoe* CHAMBERS, Can. Ent., IV, 1872, p. 24.*Epicorthylis* ZELLER, Verh. k. k. zool.-bot. Gesell. Wien, XXIII, 1873, p. 248.*Malacotricha* ZELLER, Verh. k. k. zool.-bot. Gesell. Wien, XXIII, 1873, p. 282.

Begoe Chambers is the same as *Malacotricha* Zeller, erected on the same species.

I have before me authentic specimens of the types and of all American species hitherto included in these three genera, besides several other described and undescribed species belonging to this group.

After examining them very carefully, and after comparing critically the descriptions and figures given by the authors, it is my opinion that these three genera are artificial divisions of one natural group, and that they should not be retained.

All three genera have exactly the same venation, wing form, and general habitus, and differ only in the slight modification of the hairs on second joint of the labial palpi, *Trichotaphe* being supposed to include the forms with perfectly smooth though thickened palpi; *Begoe* (*Malacotricha*) those where the hairs on the upper (inner) side of second joint are somewhat longer and looser, and *Epicorthylis* representing those where these hairs are still more developed.

However, these differences pass so gradually into each other that in most cases a species can be equally well placed in two of the genera, and species which are evidently very close otherwise will be found to differ in respect to these hairs, while others, clearly farther apart, will be found to agree in the form of the palpi.

In his characterization of *Trichotaphe* Clemens was aware of these modifications of the labial palpi, but rightfully gave them only specific value.

Zeller himself also conceded this¹ and wrote:

Wahrscheinlich haben die *Malacotrichen* gleichen Aderverlauf [as *Trichotaphe* (A. B.)]. Die kleine Verschiedenheit in der Behaarung der Taster zwischen *Malacotricha* und *Trichotaphe* hat Clemens sicher mit Recht nicht als Gattungsmerkmal betrachtet.

And anyone who will compare Zeller's figures of *Epicorthylis* and *Malacotricha*² and who knows that the venation and other characters are identical in the two forms will be apt to concede that the two genera are not separable.

The genus *Trichotaphe* as here used, including all these closely related forms is near *Ypsolophus*, and some of the species approach this genus markedly in the form of the palpi as well as in coloration.

¹ Verh. k. k. zool.-bot. Gesell. Wien, XXIII, p. 279.

² Pl. III, fig. 13 a. b. and fig. 28 a. b.

Striking instances of this are *Trichotapha setosella* Clemens compared with *Ypsolophus eupatoriella* Chambers and *Trichotapha serrativittella* Zeller compared with *Ypsolophus liquellus* Hübner.

On the other hand *Trichotapha* comes very close to *Anacampsis* Curtis, differing only in the somewhat shorter palpi and in having veins 2 and 3 in forewing stalked.

The genus has the following characters: Antennæ serrate, often more or less ciliated. Labial palpi long, recurved, second joint thickened with scales, appressed and smooth in front and laterally, smooth or more or less long-haired above (on the inside); terminal joint long, but shorter than second joint, slender, smooth, pointed. Forewings elongate, apex obtuse, 12 veins, 7 and 8 stalked, 2 and 3 stalked. Hindwings broader than forewings, slightly sinuate below apex, trapezoidal, and angle rounded; 8 veins, 3 and 4 connate with a tendency to become short-stalked, 5 approximate to 4, 6 and 7 connate with a tendency to become short-stalked. Discal vein in several species with a tendency to become obsolete.

Depressaria georgiella Walker, which Lord Walsingham placed in this genus, is unknown to me except from the description, but this, if correct, clearly shows that the species can not be a *Trichotapha*.

However, as I do not know the species, it must for the present remain in *Trichotapha*, as Walsingham has placed it, but it is not included in the synoptic table, by which the species at present recognized may be separated.

Ground color of forewings dark, nearly black.....	1
Ground color lighter, fuscous brown or yellow.....	9
1. Forewings with light costal edge.....	2
Costal edge not light.....	5
2. Head and costa reddish brown.....	<i>costarivittella</i> , p. 909
Head and costa light ochereous.....	3
3. Costal light area with curved pointed process into the dark dorsal area.....	<i>flavocostella</i> , p. 908
Costal light area without such process.....	4
4. Dorsal dark area with single rounded process into the costal light area.....	<i>inserrata</i> , p. 908
Dorsal dark area with two small sharp processes into the costal light area.....	<i>serrativittella</i> , p. 909
5. Forewings with strong metallic reflections.....	6
Forewings without such reflections.....	8
6. With light ochereous costal spot at apical third.....	<i>alacella</i> , p. 909
Without such ochereous spot.....	7
7. With small whitish dot at end of cell.....	<i>purpureofusca</i> , p. 910
Without such dot.....	<i>nonstrigella</i> , p. 910
8. Labial palpi light ochereous.....	<i>juncidella</i> , p. 910
Labial palpi dark.....	<i>melantherella</i> , p. 911
9. Ground color of forewings light ochereous with no transverse markings.....	10
Ground color gray, brown or fuscous with transverse markings.....	14
10. Forewings overlaid with dark scales.....	<i>chambersella</i> , p. 913
Forewings at most sprinkled with dark scales.....	11

11. With dark spot on fold.....	12
Without such spot.....	13
12. Forewings ochereous.....	<i>trimaculella</i> , p. 914
Forewings yellowish white.....	<i>lactiflosella</i> , p. 914
13. Head whitish.....	<i>fernaldella</i> , p. 915
Head ochereous.....	<i>bidiscomaculella</i> , p. 914
14. Costal edge ochereous.....	<i>setosella</i> , p. 911
Costal edge not ochereous.....	15
15. Head and thorax brown.....	<i>condaliavorella</i> , p. 913
Head and thorax whitish fuscous.....	<i>inversella</i> , p. 912
Not included in table.....	<i>georgiella</i> , p. 916

TRICHOTAPHE FLAVOCOSTELLA Clemens.

Gelechia ? *flavocostella* CLEMENS, Proc. Acad. Nat. Sci. Phila., 1860, p. 162; Stainton Ed. N. Am. Tin., 1872, p. 113.

Trichotaphe flavocostella CLEMENS, Proc. Ent. Soc. Phila., I, 1862, p. 131; Stainton Ed. N. Am. Tin., 1872, p. 180.—BUSCK, Dyar's List Amer. Lep., No. 5655, 1902.

Gelechia (*Trichotaphe*) *flavocostella* ZELLER, Verh. k. k. zool.-bot. Gesell. Wien, XXIII, pl. IV, fig. 26, 1873, p. 279.

Gelechia flavocostella CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 143.—COQUILLETT, Rep. State Ent. Nox. Ben. Ins. Ill., X, 1881, p. 153.

Gelechia flavicostella WALSHINGHAM, Trans. Am. Ent. Soc. Phila., X, 1882, p. 184.—RILEY, Smith's List Lep. N. Am. No. 5362, 1891.

Trichotaphe flavicostella DIETZ, Smith's List Ins. N. Jersey, 1900, p. 475.

This strikingly marked species is quite commonly taken at light in the vicinity of Washington City. It was described by Zeller from Massachusetts, while Clemens' specimen came from Maine. In the National Museum are specimens from Illinois, Iowa, New York, Missouri, District of Columbia, and Georgia.

Mr. Coquillett recorded the food plant as sunflower (*Helianthus*). It has been bred by Miss Murtfeldt and in the insectary of the Department of Agriculture from *Solidago*, from which plant I have also bred it, I am sorry to say without sufficiently careful notes to be able to give the differences between the larvæ of this and of the following species, *inserrata* Walsingham, which are quite similar. I have even a suspicion that the two species may prove to be varieties of one species.

TRICHOTAPHE INSERRATA Walsingham.

Gelechia (*Trichotaphe*) *inserrata* WALSHINGHAM, Trans. Am. Ent. Soc. Phila., X, 1882, p. 184.

Gelechia inserrata RILEY, Smith's List Lep. Bor. Am., No. 5391, 1891.

Trichotaphe inserrata BUSCK, Dyar's List Amer. Lep., No. 5656, 1902.

This species has been bred by Miss Murtfeldt and myself from *Solidago*, and is commonly found in company with the foregoing species among these plants.

The type is in Professor Fernald's collection, where I have compared it with specimen from U. S. National Museum.

The species comes to light freely.

TRICHOTAPHE SERRATIVITTELLA Zeller.

Gelechia (*Trichotaphe*) *serrativittella* ZELLER, Verh. k. k. zool.-bot. Gesell. Wien, XXIII, 1873, p. 280, pl. IV, fig. 27.

Gelechia serrativittella CHAMBERS, Can. Ent., IX, 1877, p. 24; Bull. U. S. Geol. Surv., IV, 1878, p. 147.—WALSINGHAM, Trans. Am. Ent. Soc. Phila., X, 1882, p. 184.—RILEY, Smith's List Lep. Bor. Am., No. 5480, 1891.

Gelechia plutella CHAMBERS, Can. Ent., VI, 1874, p. 238; Bull. U. S. Geol. Surv., IV, 1878, p. 146.—RILEY, Smith's List Lep. Bor. Am., No. 5449, 1891.

Trichotaphe serrativittella BUSCK, Dyar's List Amer. Lep., No. 5657, 1902.

Zeller's type is in Cambridge. The type of *Gelechia plutella* Chambers is presumably lost, but there seems no reason to doubt this apparent synonymy, which Chambers himself suggested.

In the U. S. National Museum are specimens from Kansas (Creve-cœur), and several specimens taken at light in the vicinity of Washington City by the writer.

TRICHOTAPHE COSTARUFOELLA Chambers.

Gelechia costarufuella CHAMBERS, Can. Ent., VI, 1874, p. 240.

Gelechia costarufuella CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 142.—RILEY, Smith's List Lep. Bor. Am., No. 5345, 1891.

Trichotaphe costarufuella BUSCK, Dyar's List Amer. Lep., No. 5658, 1902.

The description of this species suggests that it is a *Trichotaphe*, and this was verified by examining types in Professor Fernald's collection and in the Museum of Comparative Zoology in Cambridge, all in miserable condition, but bearing Chambers' labels and undoubtedly representing this species, which is easily recognized by Chambers' description.

One specimen of this species is in the U. S. National Museum, which Lord Walsingham by mistake has labeled *Trichotaphe setosella*? It has no locality label.

Chambers' types are from Texas.

TRICHOTAPHE ALACELLA Clemens.

Trichotaphe alacella CLEMENS, Proc. Ent. Soc. Phila., 1860, p. 132; Stainton Ed. N. Am. Tin., 1872, p. 180.—DIETZ, Smith's List Ins. N. Jersey, 1900, p. 474.—BUSCK, Dyar's List Amer. Lep., No. 5659, 1902.

Gelechia alacella CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 141.—RILEY, Smith's List Lep. Bor. Am., No. 5302, 1891.

Gelechia (*Trichotaphe*) *ochripalpella* ZELLER, Verh. k. k. zool.-bot. Gesell. Wien, XXIII, 1873, p. 279.—WALSINGHAM, Trans. Am. Ent. Soc. Phila., X, 1882, p. 183.

Gelechia ochripalpella CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 145.

Gelechia goodella CHAMBERS, Journ. Conn. Soc. Nat. Hist., III, 1881, p. 289.

Zeller changes the name of this species because of the preoccupation of *alacella*, but this contention will not hold on account of *Acanthophila alacella* Dupont, and the present species should be known under Clemens' original name.

I have examined Chambers' type of *Gelechia goodella* in Professor Fernald's collection, which Lord Walsingham had before him in 1882. It is undoubtedly the same as Clemens' species, the type of which is lost. Chambers' type came from Massachusetts, Clemens' type presumably from Pennsylvania; Zeller's specimens were from Washington City.

In the U. S. National Museum are specimens from all these localities and from New York.

TRICHOTAPHE PURPUREOFUSCA Walsingham.

Gelechia (Trichotaphe) purpureofusca WALSINGHAM, TRANS. AM. ENT. SOC. PHILA., X, 1882, p. 184.

Gelechia purpureofusca RILEY, SMITH'S LIST LEP. BOR. AM., NO. 5458, 1891.

Trichotaphe purpureofusca BUSCK, DYAR'S LIST AMER. LEP., NO. 5660, 1902.

This splendid insect I have easily identified among the unnamed material in the U. S. National Museum. I have later examined the type in Professor Fernald's collection.

It is our largest described species of this genus. The large orange-yellow palpi contrast strikingly with the dark purplish shining forewings.

Food plant is not known.

TRICHOTAPHE NONSTRIGELLA Chambers.

Dasyneris nonstrigella CHAMBERS, BULL. U. S. GEOL. SURV., IV, 1878, pp. 92, 138.—

RILEY, SMITH'S LIST LEP. BOR. AM., NO. 5546.

Trichotaphe nonstrigella BUSCK, DYAR'S LIST AMER. LEP., NO. 5661, 1902.

This species was described from a single female specimen, collected in Kentucky, "resting on a leaf in the woods June 30."

This unique type is found in the Museum of Comparative Zoology in Cambridge, in easily recognizable condition, agreeing minutely with Chambers' description and bearing his label.

It was somewhat of a surprise to find it to be a *Gelechiid* with wing-form, venation, and palpi agreeing exactly with the present genus.

The densely ciliated antennæ which Chambers describes surely are remarkable. Ciliate and serrate antennæ are found in all the species of *Trichotaphe*, but in this species they are unusually developed.

Still, there is no doubt that the species rightfully belongs to the present genus and quite near the foregoing species.

In the U. S. National Museum is a single specimen from Kansas (Crevecoeur), and I have examined one other specimen collected near Chambers' locality by Miss Annette Braun of Cincinnati, Ohio.

TRICHOTAPHE JUNCIDELLA Clemens.

Trichotaphe juncidella CLEMENS, PROC. ACAD. NAT. SCI. PHILA., 1860, p. 166; STANTON ED. N. AM. TIN., 1872, p. 122.—BUSCK, DYAR'S LIST AMER. LEP., NO. 5662, 1902.

- Gelechia juncidella* CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 144.
Gelechia (*Trichotaphe*) *juncidella* WALSHINGHAM, Trans. Am. Ent. Soc. Phila., X, 1882, p. 183.
Gelechia pallipalpis WALKER, Cat. Lep. Het. Brit. Mus., XXIX, 1864, p. 506.
Depressaria? *dubitella* CHAMBERS, Can. Ent., IV, 1872, pp. 90, 91, 92, 128.
Gelechia dubitella CHAMBERS, Can. Ent., IV, 1872, p. 147; Bull. U. S. Geol. Surv., IV, 1878, p. 116.
Gelechia (*Cryptolechia*) *dubitella* CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 143.
Depressaria (*Gelechia*) *dubitella* MURTFELDT, Can. Ent., VI, 1874, p. 221.
Gelechia hallipalpis RILEY, Smith's List Lep. Bor. Am., No. 5394, 1891.

Lord Walsingham is responsible for the synonymy which seems probable from the descriptions. What caused Riley to give Walker's name [misspelled] precedence in his list I do not know, but the species ought to be known as *juncidella* Clemens, as shown by Lord Walsingham.

It is one of the most common Gelechiidae in the vicinity of Washington. Miss Murtfeldt has recorded its food plant as *Ambrosia artemisiifolia*; I have reared large series from this plant, and also from *A. tripartita*, and from *Solidago* and *Aster*. The larva, which is well described by Miss Murtfeldt, folds the edge of the leaf and pupates within the fold. There are at least two generations in the locality of Washington City.

Chambers described his species from Kentucky; Miss Murtfeldt's specimen came from Missouri, and Clemens' specimen presumably from Pennsylvania. In the National Museum are specimens from the following localities: Canada, Kansas, Maine, District of Columbia, Virginia, Maryland, Maine.

TRICHOTAPHE MELANTHERELLA Busck.

- Trichotaphe melantherella* BUSCK, Proc. U. S. Nat. Mus., XXIII, 1900, p. 232, pl. 1, fig. 2; Dyar's List Amer. Lep., No. 5663, 1902.—DYAR, Proc. Ent. Soc. Wash., IV, 1901, p. 472.

Type.—No. 4039, U.S.N.M.

Food plant.—*Melanthera deltoidea*.

Habitat.—Palm Beach, Florida.

TRICHOTAPHE SETOSELLA Clemens.

- Trichotaphe setosella* CLEMENS, Proc. Acad. Nat. Sci. Phila., 1860, p. 160; Stainton Ed. N. Am. Tin., 1872, p. 121.—ZELLER, Verh. k. k. zool.-bot. Gesell. Wien, XXIII, 1873, p. 282.—BUSCK, Dyar's List Amer. Lep., No. 5664, 1902.
Gelechia setosella CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 147.
Begon costolutella CHAMBERS, Can. Ent., IV, 1872, p. 209; Can. Ent., IX, 1877, p. 24.
Gelechia (*Malacotricha*) *bilobella* ZELLER, Verh. k. k. zool.-bot. Gesell. Wien, XXIII, 1873, p. 280, pl. iv, fig. 28, a, b.—WALSINGHAM, Trans. Am. Ent. Soc. Phila., X, 1882, p. 185.

Gelechia bilobella RILEY, Smith's List Lep. Bor. Am., No. 5325, 1891.

The great similarity in coloration and size between the two species, *Trichotaphe setosella* Clemens = *Begon costolutella* Chambers = *Malaco-*

triche bilabella Zeller, and *Ypsolophus* (*Nothris*) *eupatoriella* Chambers = *Nothris dolabella* Zeller has very naturally caused some trouble.

A large series of both species is before me. The *Ypsolophus* species I have bred from *Eupatorium* in Washington City, and there can be no doubt but that it represents *eupatoriella* Chambers, nor that this is synonymous with Zeller's *dolabella*, as thought by Lord Walsingham; but I can not agree with his Lordship in placing *setosella* Clemens as synonymous with this species.

Clemens was well acquainted with the genus *Ypsolophus*, and would undoubtedly have placed his species in that genus had it belonged there. His description fits the *Trichotaphe* species better than the other species, and even if there was a doubt it seems reasonable to give Dr. Clemens the benefit thereof, and not remove his species from the genus which he himself had erected and surely should be supposed to know.

Lord Walsingham was led to his conclusions through a specimen labeled *setosella* in C. T. Robinson's collection, but it seems much more natural to suppose that this specimen was wrongly labeled—taking in consideration the great similarity of the two species—than to suppose that Dr. Clemens should not have known an *Ypsolophus* when he saw one, but should have described it wrongly under another—and his own—genus.

Clemens' type is no longer in existence, so absolute proof can not be obtained; but the circumstantial evidence speaks for Zeller's view, that *setosella* is a *Trichotaphe* [*Melachotriche*], as originally described by Clemens.

Habitat.—District of Columbia, Ohio (Zeller), Kentucky (Chambers), Pennsylvania (Clemens). In the U. S. National Museum are specimens from New York and Texas.

TRICHOTAPHE INVERSELLA Zeller.

Epicorthis inversella ZELLER, Verh. k. k. zool.-bot. Gesell. Wien, XXIII, 1873, p. 248, pl. III, fig. 13, a, b.—CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 140; Can. Ent., X, 1878, p. 54; Journ. Cinn. Soc. Nat. Hist., II, 1880, pp. 198, 202, fig. 13.—RILEY, Smith's List Lep. Bor. Am., No. 5559, 1891.

Trichotaphe inversella BUSCK, Dyar's List Amer. Lep., No. 5665, 1902.

I have examined specimens determined by Chambers in the U. S. National Museum and in Professor Fernald's collection; also several other specimens in the National Museum, and in Dr. Dietz's collection, all agreeing with Zeller's type in the Museum of Comparative Zoology, in Cambridge, and with his description and figure.

The difference in labial palpi is only a difference in degree, not in kind, and the species can well be included in *Trichotaphe* on that account.

Zeller writes that veins 7 and 8 in forewing "die Flügelspitze umfasst;" but the apex in this species, as in most of the species belong-

ing to *Trichotaphe*, is not pointed, but rounded. It is a matter of taste where the extreme point is, and it can just as well be said that veins 7 and 8 go to costa, as is characteristic for the entire family *Gelechiidæ*.

Chambers' figure of the venation of this species¹ is wrong in several points besides the one in hindwing, corrected by Chambers in the margin of H. Edwards' copy and recorded by Mr. William Bentenmüller.² The form of the wing is not correct, the stalk of veins 2 and 3 in forewings is longer than represented in the figure and vein 8 is omitted.

All the specimens I have met with came from Texas.

TRICHOTAPHE CONDALIAVORELLA Busck.

Trichotaphe condaliavorella Busck, Proc. U. S. Nat. Mus., XXIII, 1900, p. 232; Dyar's List Amer. Lep., No. 5666, 1902.—DYAR, Proc. Ent. Soc. Wash., IV, 1901, p. 473.

Type.—No. 4940, U.S.N.M.

Food plant.—*Condalia ferrea*.

Habitat.—Palm Beach, Florida.

TRICHOTAPHE CHAMBERSELLA Murtfeldt.

Gelechia chambersella MURTFELDT, Can. Ent., VI, 1874, p. 222, Can. Ent., XIII, 1881, p. 242.—CHAMBERS, Cinn. Quart. Journ. Sci., II, 1875, p. 240; Bull. U. S. Geol. Surv., IV, 1878, pp. 116, 142.—RILEY, Smith's List Lep. Bor. Am., No. 5336, 1891.

Gelechia inæquepulella CHAMBERS, Cinn. Quart. Journ. Sci., II, 1875, p. 239; Bull. U. S. Geol. Surv., IV, 1878, p. 144.—RILEY, Smith's List Lep. Bor. Am., No. 5388, 1891.

Trichotaphe chambersella Busck, Dyar's List Amer. Lep., No. 5667, 1902.

There may be some question as to the right of giving Miss Murtfeldt's name priority; but inasmuch as she certainly had her name in print (though without description of the species) and inasmuch as her biological note on the food plant given at that time really is of quite as much value in recognizing the species as Chambers' mere excuse for a description, I give her name preference, the more so because it surely was Chambers' inexcusable fault that a synonym was made, and because only through Miss Murtfeldt has the species and its synonymy been finally cleared up.

It appears from correspondence I have had with Miss Murtfeldt that she sent the first specimen bred by her to Chambers for determination; that he pronounced it a new species and agreed that Miss Murtfeldt should name it after him; that he thereafter, on the single specimen received from Miss Murtfeldt, made a new species, *inæquepulella*, forgetting or mistaking the identity of the specimen in such a degree that he, on the very next page, mentions having received such a specimen and compares it with his *ambrosiæella*.

This single original type specimen is still found in Cambridge in

¹ Journ. Cinn. Soc. Nat. Hist., II, p. 202, fig. 13.

² Ent. Am., V, p. 37.

poor but recognizable condition, labeled by Chambers *inæquepudella*, and proving beyond a doubt that it really is Miss Murtfeldt's species.

In Amherst, in Professor Fernald's collection, I have examined Miss Murtfeldt's type, and I have also received identical authenticated specimens from Miss Murtfeldt.

In the U. S. National Museum are, besides these, two identical specimens bred by Mr. Coquillett in Los Angeles, California, from the same food plant as Miss Murtfeldt recorded, *Ambrosia artemisiifolia*. Mr. Coquillett has kindly given me his notes on the larva, which are identical with Miss Murtfeldt's careful description. I have also bred the species from same food-plant in Washington and in Kentucky.

TRICHOTAPHE LACTIFLOSELLA Chambers.

Gelechia lactiflosella CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, pp. 89, 144.—

RILEY, Smith's List Lep. Bor. Am., No. 5398, 1891.

Trichotaphe lactiflosella BUSCK, Dyar's List Amer. Lep., No. 5668, 1902.

The unique type of this easily recognized, large, light-yellow species was found in the Museum of Comparative Zoology in Cambridge, in good condition, authenticated by Chambers' label and agreeing with his description.

I have taken several specimens of this species this summer at light on Plummers Island in the Potomac River, Maryland.

The type is from Texas.

TRICHOTAPHE TRIMACULELLA Chambers.

Gelechia trimaculella CHAMBERS, Can. Ent., VI, 1874, p. 238; Bull. U. S. Geol. Surv., IV, 1878, p. 147.—RILEY, Smith's List Lep. Bor. Am., No. 5500, 1891.

Trichotaphe trimaculella BUSCK, Dyar's List Amer. Lep., No. 5669, 1902.

Chambers' type from Miss Murtfeldt's collection, now in Professor Fernald's possession, agrees with his types in Cambridge and with his description.

It is an easily recognized species, of which I have found examples in the unnamed material in the U. S. National Museum.

It is a typical *Trichotaphe* and has a similar very striking counterpart in *Ypsolophus touceyellus* Busck (*Anarsia trimaculella* Chambers) (p. 922), as *Trichotaphe setosella* has in *Ypsolophus eupatoriella* (p. 925).

This recurring specific similarity between species of the two genera is an interesting proof of their near relationship. The species was described from Kentucky; the specimen in the U. S. National Museum came from Texas. I have also taken it at light in District of Columbia.

TRICHOTAPHE BIDISCOMACULELLA Chambers.

Gelechia bidiscomaculella CHAMBERS, Can. Ent., VI, 1874, p. 241; Bull. U. S. Geol. Surv., IV, 1878, p. 141.—RILEY, Smith's List Lep. Bor. Am., No. 5324, 1891.

Trichotaphe bidiscomaculella BUSCK, Dyar's List Amer. Lep., No. 5670, 1902.

Chambers described his *Gelechia bidiscomaculella* from a single specimen, with palpi missing, collected in Texas. This type specimen is no longer in existence, and absolute certainty concerning the species is therefore not obtainable.

Chambers says that it is "perhaps a variety of *subruberella* Chambers," described on the same page, which species, he again writes, is "perhaps a variety of *rufusella* Chambers," and which I, after careful consideration of all the material of *rufusella* [= *Anacamptis fullonella* Zeller, p. 849], had placed as synonym of that species.

It is evident that *bidiscomaculella* must be very similar to this species.

In Professor Fernald's collection is what was supposed to be a type of *Gelechia rufusella*, with label to that effect in Chambers' handwriting. This specimen is from Texas, wherefrom both the above species were described, and it is very similar specifically to *rufusella* (*Anacamptis fullonella*), but belongs to the genus *Trichotaphe*, and could not be *rufusella*, because Chambers expressly emphasizes that this species has the terminal joint of labial palpi longer than second joint, as have also the other types of *rufusella*, while the specimen in Professor Fernald's collection has the terminal joint decidedly shorter than second.

It agrees with Chambers' short description of *Gelechia bidiscomaculella*, and, aside from the difference in the length of labial palpi, differs from *rufusella* in having underside of thorax and legs black, with narrow white annulations on the tarsi. Second joint of palpi is also deep black on the underside except at apex.

I believe this specimen represents *Gelechia bidiscomaculella*, and have consequently referred that species to the present genus.

I know of no other specimens of this species.

TRICHOTAPHE FERNALDELLA, new species.

Trichotaphe fernaldella Busck, Dyar's List Amer. Lep., No. 5671, 1902.

Antennæ dark fuscous with narrow yellow annulations; cilia less than I. Labial palpi long, perfectly smooth, light straw yellow; second joint thickened with appressed scales, terminal joint nearly as long as second. Face, head, and thorax light straw yellow. Forewings more pointed than usual in the genus, light straw yellow with the intervals between the veins slightly deeper colored.

One dark fuscous round dot is on the middle of the cell, another similar one at the end of the cell. Around the apical edge is a thin dark line, and just inside this along the edge of the wing is a row of small dark fuscous dots. Cilia whitish yellow with two indistinct yellowish fuscous lines parallel with the edge of the wing. Hindwings very light whitish straw colored, the edge darker; cilia white.

Abdomen yellowish white. Legs light straw colored without any markings.

Alar expanse.—18 mm.

Habitat.—Orono, Maine.

Type.—No. 6393, U.S.N.M.

Other specimens in Professor Fernald's collection.

The species has a certain general resemblance to *Gelechia petasitis* Pfaffenzeller, with which species it had been confounded in Professor Fernald's collection.

I am glad to name this very distinct species after Professor Fernald, to whom the U. S. National Museum is indebted for the type and to whom the writer is under many obligations for much valuable help kindly extended during these studies.

TRICHOTAPHE? GEORGIELLA Walker.

Depressaria georgiella WALKER, Cat. Lep. Het. Brit. Mus., XXXV, 1866, p. 1827.

Trichotaphe georgiella WALSHINGHAM, Proc. Zool. Soc. Lond., 1891, p. 312.—BUSCK, Proc. U. S. Nat. Mus., XXIV, 1902, p. 731; Dyar's List Amer. Lep., No. 5672, 1902.

Walker says in his description of this species:

Second joint of labial palpi with a long tuft at the tip beneath, third joint much longer than second.

Which clearly shows that it can not be a *Trichotaphe*, as suggested by Lord Walsingham; but as I have not recognized the species, type of which is in Lord Walsingham's possession, it must for the present remain in this genus, as he has placed it.

GLYPHIDOCERA Walsingham.

Plate XXXII, fig. 34.

Glyphidocera WALSHINGHAM, Proc. Zool. Soc. Lond., 1891, p. 531, pl. xli, fig. 8.

Antennæ slightly serrate and in the males deeply notched on the upper side of the joint next to the basal one; in the females simple, without notch, but the outer end of the basal joint is somewhat enlarged. Maxillary palpi obsolete. Labial palpi long, recurved, smooth, somewhat compressed laterally, sharpened in front; terminal joint pointed, shorter than second joint. Forewing elongate, rounded at apex, slightly arched at extreme base of costa, costal and dorsal edge parallel; 11 veins, vein 8 absent, 7 to costa, 2 and 3 stalked. Hindwings twice as broad as forewings, termen slightly sinuate, 8 veins, 3 and 4 stalked, 6 and 7 stalked.

The notched antennæ in the male are exceptional in the family Gelechiidae, and found only in this and in the following genus; they are exactly similar to the antennæ found in some of the Blastobasidae.

Lord Walsingham placed this genus in Xyloryctidae, but it falls naturally in the present family.

The two recognized American species of this genus may easily be

separated by the characters given below. I have met with two other species of this genus, but have not sufficient good material to describe them.

With face, head, and thorax dark fuscous *floridanella*, p. 917.
 With face, head, and thorax light ochreous *æquepulvella*, p. 917.

GLYPHIDOCERA FLORIDANELLA Busck.

Glyphidocera floridanella Busck, Proc. Ent. Soc. Washington, IV, 1901, p. 474;
 Dyar's List Amer. Lep., No. 5673, 1902.

Type.—No. 5663, U.S.N.M.

Habitat.—Palm Beach, Florida.

GLYPHIDOCERA ÆQUEPULVELLA Chambers.

Gelechia æquepulvella CHAMBERS, Can. Ent., IV, 1872, p. 192, (Can. Ent., VI, 1874, p. 230; Cinn. Quart. Journ., II, 1875, p. 246; Bull. U. S. Geol. Surv., III, 1877, pp. 125, 141; IV, 1878, p. 141.—RILEY, Smith's List Lep., Bor. Am., No. 5300, 1891.

Glyphidocera æquepulvella Busck, Proc. Ent. Soc. Wash., IV, 1901, p. 475; Dyar's List Amer. Lep., No. 5674, 1902.

In the Museum of Comparative Zoology in Cambridge was found 11 specimens labeled by Chambers *Gelechia æquepulvella* and agreeing with his description.

They unquestionably represent this species and show that it belongs to the present interesting genus.

I have met with only one other specimen in U. S. National Museum, from Texas, probably received from Chambers, who also recorded the species from Kentucky, Colorado, and California.

ANORTHOSIA Clemens.

Plate XXXII, fig. 35

Anorthosia CLEMENS, Proc. Acad. Nat. Sci. Phila., 1860, p. 156.

Sugartitis CHAMBERS, Can. Ent., IV, 1872, p. 225.

Antennæ in male with deep notch above near base like in the preceding genus; in female simple, without the notch. Labial palpi with second joint clothed beneath with porrected appressed long stiff hairs, above with large expansible tuft of hairs; terminal joint erect, slender, pointed. Forewings elongate, narrow, pointed; 12 veins, 7 and 8 stalked to costa, 2 and 3 stalked. Hindwings narrower than forewings, pointed, termen sinuate below apex; 8 veins, 3 and 4 connate, 5 approximate to 4, 6 and 7 connate, transverse vein nearly obsolete between 5 and 6.

Clemens says in his description and shows in his figure that terminal joint of labial palpi is emitted from apical third of second joint, while it in reality is emitted from the end of second joint proper, as denuding shows, and only look otherwise on account of the protruding hairs on the underside.

Strangely enough neither Clemens nor Lord Walsingham observed the striking antennal structure in the male; Clemens' figure of the antennæ is that of the female.

Lord Walsingham writes¹ that veins 3 and 4 in hindwing are separate in *Anorthosia*. This is a mistake and in variance with Clemens' description and figure as well as with specimens of *Anorthosia punctipennella*, undoubtedly correctly determined by Lord Walsingham in the collections of U. S. National Museum, Dr. Dietz, Professor Fernald, and in the Philadelphia Academy of Natural Sciences, bearing Walsingham's blue labels No. 319, 327, and others.

And if *Anorthosia straminea* Walsingham, described from Africa, has the alleged venation it can not properly be included in this genus.

Of Chambers' genus *Suguritis* no authentic material exists, but his description leads me to believe that it must be identical with *Anorthosia*, though several minor details of his figure of the venation differ from the true venation of *Anorthosia*; but nearly all of Chambers' delineations are more or less incorrect and can not be depended upon.

I am so fortunate as to have my opinion corroborated by Lord Walsingham, who independently concluded that *Suguritis* was synonymous with *Anorthosia*, but still this question will be open to doubt until we know the American fauna much more intimately than we do now.

Only the two species are included, and I feel rather confident that Chambers' species is even specifically identical with *Anorthosia punctipennella*, and can not, from his short description, choose any differences from that species which may not be omissions caused by an imperfect specimen used as type; but at present I think it more proper and safe to retain *gracilella* as a distinct species until further knowledge of our fauna is obtained.

ANORTHOSIA PUNCTIPENNELLA Clemens.

Anorthosia punctipennella CLEMENS, Proc. Acad. Nat. Sci. Phila., 1860, p. 15; Stainton Ed. N. Am. Tin., 1872, p. iii.—CHAMBERS, Can. Ent., IV, 1872, p. 225; VI, 1874, p. 245.—WALSINGHAM, Trans. Ent. Soc. Lond., 1891, p. 110.—RILEY, Smith's List Lep. Bor. Am., No. 5522, 1891.—BUSCK, Dyar's List, Amer. Lep., No. 5675, 1902.

Clemens's type is lost, but there is no difficulty in identifying this peculiar species. I have examined many specimens determined by Lord Walsingham, who had seen Clemens' original specimen, and I have repeatedly taken this species in the vicinity of Washington.

The highly specialized palpi give the insect a peculiar bearded appearance when it is excited and spreads the long hairs out laterally on each side of the face. The early stages are not known.

Habitat.—Eastern United States.

¹ Trans. Ent. Soc. Lond., 1891, p. 110.

ANORTHOSIA GRACILELLA Chambers.

Sagaritis gracilella CHAMBERS, Can. Ent., IV, 1874, p. 226; Bull. U. S. Geol. Surv., IV, 1878, p. 162.—RILEY, Smith's List Lep. Bor. Am., No. 5544, 1891.
Anorthosia gracilella, BUSCK, Dyar's List Amer. Lep., No. 5676, 1902.

The species is unknown to me if it does not eventually prove the same as the foregoing, when it is found that the description can not be applied to any other Gelechiid.

Habitat.—Kentucky.

ENCHRYSA Zeller.

Enchrysa ZELLER, Verh. k. k. zool.-bot. Gesell. Wien, XXIII, 1873, p. 282.

I am not personally acquainted with this genus except from Zeller's description and figure and from the following notes kindly sent me by Mr. J. Hartley Durrant on the unique type in Lord Walsingham's collection.

As Zeller's generic description and figure certainly must be incorrect, I have relied exclusively on the notes on the type, which are as follows:

Type minus abdomen and one hindwing and the whole insect rickety. I found this very difficult to study, fearing it would fall to pieces at the least jar. It is a very distinct thing; you will know it at once if you see a specimen. Antennæ dentate, palpi smooth, terminal joint distinctly shorter than median. Forewings impressed on costa toward apex; 12 veins, 7 and 8 stalked, 7 to immediately above apex, 3 from before angle of cell. Hindwings elongate, widening outward; apex pointed, produced; termen excavate beneath apex, slightly emarginate above tornus; 8 veins, 3, 4, and 5 remote, nearly parallel, 7 and 8 remote. Very close to *Aristotelia*, from which I think it is perhaps separable, but I have had great difficulty in studying the type. Zeller's figure satisfactory so far as it goes. I dare not trust this specimen to the post; it would certainly fall all to pieces.

I have placed this genus, following Zeller, next to *Ypsolophus*, but it does seem evident that it is much nearer *Aristotelia*, as Mr. Durrant writes.

Only the one species has been described.

ENCHRYSA DISSECTELLA Zeller.

Enchrysa dissectella ZELLER, Verh. k. k. zool.-bot. Gesell. Wien, XXIII, 1873, p. 283, pl. IV, fig. 29ab.—CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 140.—RILEY, Smith's List Lep. Bor. Am., No. 5593, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5677, 1902.

The unique type is in the Walsingham's collection. It was described from Ohio.

No other specimen has been recognized, but it must be a striking little animal, and should be recognized from Zeller's figure and description without any difficulty.

YPSOLOPHUS Fabricius.

Ypsolophus FABRICIUS, Supplementum Ent. Syst., Hafnise, 1798, p. 421, pl. xxxvi.

Labial palpi long curved, second joint thickened, with dense projecting tuft of long hairs beneath, sometimes rough above; terminal as long or longer than second, slender pointed.

Forewings with 12 veins, 7 and 8 stalked, 2 and 3 stalked; hindwings as broad or broader than forewings, trapezoidal apex obtusely pointed, termen slightly sinuate; 8 veins, 3 and 4 connate or stalked, 5 approximate to 4, 6 and 7 closely approximate, connate or stalked.

Mr. E. Meyrick made *Nothris* Hübner synonymous with *Ypsolophus*,¹ and the species hitherto placed in that genus in America, which are known to me, conform well with the definition of *Ypsolophus*, except *Nothris malignemella* Murtfeldt, which is a *Blastobasid*, lately referred to the genus *Holcocera* Clemens,² and *Ypsolophus trinaculellus* Fitch, which has been discovered to belong to the family Cœcophoridae and has been made the type of a new genus *Eumeyrickia* Busck.³

The other species probably belong in the present genus, but unfortunately some of them are known only from the descriptions, all authentic material being lost.

By continued breeding of good series of *Ypsolophus*, however, all of them may in time be rediscovered, but at present it is not safe from the more or less meager descriptions to even include them in the following table, which then only contains such species as are recognized at present.

Hindwings bluish, iridescent semitransparent.....	<i>ligulellus</i> , p. 921
Hindwings not so.....	1
1. Forewings with dark dorsal spot at apical third.....	<i>citrifoliellus</i> , p. 923
Forewings without such spot.....	2
2. Forewings with large black spot on disk.....	<i>eupatoriellus</i> , p. 925
Forewings without large spot on disk.....	3
3. Forewings with distinct discal spots.....	4
Forewings without distinct discal spots.....	<i>caryophyllus</i> , p. 923
4. Discal spots light brown.....	<i>punctidiscellus</i> , p. 922
Discal spots not light brown.....	5
5. With no white scales in discal spots.....	6
With white scales in discal spots.....	7
6. With apical row of black dots.....	<i>bipunctellus</i> , p. 923
Without such row of apical dots.....	<i>touceyellus</i> , p. 922
7. White part of discal spots large, prominent.....	<i>trinacellus</i> , p. 923
White part of discal spots small, not prominent.....	<i>ventrellus</i> , p. 924
Not included in synoptic table: <i>malifoliellus</i> , p. 925; <i>quercicellus</i> , p. 926; <i>roseocinctellus</i> , p. 926; <i>bimaculellus</i> , p. 926; <i>griseicellus</i> , p. 927; <i>rusticus</i> , p. 927.	

¹Trans. Ent. Soc. Lond., 1887, p. 274.

²Journ. New York Ent. Soc., X, 1902, p. 96.

³Journ. N. Y. Ent. Soc., X, 1902, p. 94.

YPSOLOPHUS LIGULELLUS Hubner.

- Dichomeris ligulella* Hübner, Zutrage exot. Schmett., 1818, p. 70, figs. 143, 144.
Rhinocera pomatella Harris, Cambridge Cron., July 17, 1853.
Chaetochilus pomatellus Fitch, Journ. N. Y. State Agr. Soc., IV, 1853, p. 36; Trans. N. Y. State Agr. Soc., XIII, 1854, p. 178.
Ypsolophus pomatellus Chambers, Bull. U. S. Geol. Surv., IV, 1878, p. 166.—Walsingham, Trans. Am. Ent. Soc. Phila., X, 1882, p. 186.—Riley, Smith's List Lep. Bor. Am., No. 5527, 1891.—Dietz, Smith's List Ins. New Jersey, 1900, p. 475.—Slingerland, Cornell Univ. Agr. Exp. Sta. Bull., 1901, p. 187.
Chaetochilus contubernatellus Fitch, Journ. N. Y. State Agr. Soc., IV, 1853, p. 36; Trans. N. Y. State Agr. Soc., XIII, 1854, p. 178.
Ypsolophus contubernatellus Riley, Smith's List Lep. Bor. Am., No. 5525, 1891.
Ypsolophus puniciguttellus Clemens, Proc. Ent. Soc. Phila., II, 1863, p. 123; Stainton Ed. Tin. N. Am., 1872, p. 228.—Zeller, Verh. k. k. zool.-bot. Gesell. Wien, XXIII, 1873, p. 283.
Ypsolophus flavivittellus Clemens, Proc. Ent. Soc. Phila., II, 1863, p. 429; Stainton Ed. Tin. N. Am., 1872, p. 254.
Ypsolophus redella Chambers, Can. Ent., IV, 1872, p. 222.
Ypsolophus ruderella Chambers, Bull. U. S. Geol. Surv., IV, 1878, p. 167.
Ypsolophus quercipomonella Chambers, Can. Ent., IV, 1872, p. 222.—Packard, Rep. U. S. Ent. Comm., V, 1890, p. 202.
Ypsolophus ligulellus Busck, Dyar's List Amer. Lep., No. 5678, 1902.

In the U. S. National Museum are Fitch's types of *pomatellus* and *contubernatellus*, and specimens labeled by Lord Walsingham (blue labels No. 666, 1195, 1222, and 1223); *puniciguttellus*, *pomatellus*, *flavivittellus*, and *contubernatellus*=*quercipomonellus*=*flavivittellus*.

There are besides many specimens reared from oak and from apple in the insectary of the U. S. Department of Agriculture and also specimens from New York (Beutenmüller); Missouri (Murtfeldt); Georgia, from live oak (Schwarz); Kansas (Crévecœur); Pennsylvania (Heidemann); West Virginia (bred from oak); District of Columbia and Maryland (Busck). I have also determined specimens from New Jersey (Kearfott) and from New Mexico (Cockerell).

As the consensus of authorities is that Hübner's figures represent this species (the variety *flavivittellus* Clemens) and as additional evidence for or against this view can not be forthcoming, it seems rational to adopt Hübner's name instead of continuing to use the query.

Lord Walsingham is responsible for the entire synonymy¹ which Zeller already had indicated in part, and it must stand until disproved, the more so as new and careful observations by Mr. Slingerland, who has lately treated this insect very interestingly and exhaustively, seem to confirm it. But Lord Walsingham expresses a doubt, and it does seem to me likely, that at least two distinct species will be ultimately found to have been mixed up, one feeding on oak and one on apple.

From the material at my command at present, however, though quite large, no conclusions can be made, and I am unable to separate

¹ Trans. Am. Ent. Soc. Phila., X, p. 186.

the imagoes according to food plant therefrom, it being too scant and too uncertainly labeled. Most careful observations of the larva from both food plants with this object in view are necessary to clear up the question.

YPSOLOPHUS PUNCTIDISCELLUS Clemens.

Ypsolophus punctidiscellus CLEMENS, Proc. Ent. Soc. Phila., II, 1863, p. 123; Stainton Ed. Tin. N. Am., 1872, p. 228.—ZELLER, Verh. k. k. zool.-bot. Gesell. Wien, XXIII, 1873, p. 285.—CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 166.—RILEY, Smith's List Lep. Bor. Am., No. 5528, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5679, 1902.

Ypsolophus stramineellus CHAMBERS, Can. Ent., IV, 1872, p. 224; Bull. U. S. Geol. Surv., IV, 1878, p. 167.—RILEY, Smith's List Lep. Bor. Am., No. 5531, 1891.

A perfect specimen in the National Museum labeled "Boll, Texas," was determined by Lord Walsingham; it agrees perfectly with the description and undoubtedly represents this species, type of which, like the majority of Clemens' types, is lost.

I have several fine specimens collected in New Jersey by Mr. Kearfott and in the District of Columbia by myself. The species comes freely to light.

Chambers' description of *stramineellus*, of which no type is in existence, seems to warrant the synonym with Clemens' species, as suggested by Chambers himself.

YPSOLOPHUS TOUCEYELLUS Busck.

Anarsia trimaculella CHAMBERS, Can. Ent., VI, 1872, p. 243; Bull. U. S. Geol. Surv., IV, 1878, pp. 92, 129.—WALSINGHAM, Proc. Zool. Soc. Lond., 1891, p. 526.—RILEY, Smith's List Lep. Bor. Am., No. 5539, 1891.

Ypsolophus touceyellus BUSCK, Dyar's List Amer. Lep., No. 5680, 1902.

Renamed after the author, Victor Toucey Chambers.

By transferring this species to its proper genus the name *trimaculella* becomes preoccupied by *Ypsolophus* [*Chietochilus*] *trimaculellus* although, as I have shown, this is not an *Ypsolophus*, nor even a *Gelechiid*, but an *Ecophorid*, forming a new genus, *Eumeyrickia* Busck.¹

I have compared Chambers' type (no. 470) of *Anarsia trimaculella* in the U. S. National Museum and found it identical with a specimen in Cambridge Museum labeled by Chambers. This specimen was formerly the property of the Peabody Institute in Salem, Massachusetts, and bears Lord Walsingham's blue label no. 994, corresponding to his determination in his handwritten notebook: *Anarsia trimaculella* Chambers.

The National Museum specimen is Chambers' true type from Texas, while the Cambridge specimen is his later example from Kentucky.

The species is a true *Ypsolophus*. I have met with no other specimens.

¹Journ. N. Y. Ent. Soc., X, 1902, p. 94.

YPSOLOPHUS BIPUNCTELLUS Walsingham.

Ypsolophus bipunctellus WALSINGHAM, Trans. Amer. Ent. Soc. Phila., X, 1886, p. 186.—RILEY, Smith's List Lep. Bor. Am., No. 5523, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5681, 1902.

The type of this species is in Professor Fernald's collection, where I have examined it; identical specimen from Nantucket Island, Massachusetts, is in the U. S. National Museum. (Ac. No. 34727.)

YPSOLOPHUS TRINOTELLUS Coquillett.

Nothris trinotella COQUILLETT, Papilio, III, 1883, p. 81.—PACKARD, Rep. U. S. Ent. Comm., V, 1890, p. 640.

Ypsolophus trinotellus BUSCK, Dyar's List Amer. Lep., No. 5682, 1902.

Type of this very distinct species is in Professor Fernald's collection in very poor condition, consisting of head, thorax, and one forewing. The species is, however, different from all others described, and easily recognized from the description.

Food plant.—Hazel.

Habitat.—Illinois.

YPSOLOPHUS CITRIFOLIELLUS Chambers.

Nothris citrifoliella CHAMBERS, Journ. Cinn. Soc. Nat. Hist., II, 1880, p. 184.—COMSTOCK, Rep. U. S. Dept. of Agr., 1880, p. 205.—RILEY, Smith's List Lep. Bor. Am., No. 5536, 1891.

Ypsolophus citrifoliellus BUSCK, Dyar's List Amer. Lep., No. 5683, 1902.

The original bred series from which Chambers described this species is still in U. S. National Museum in fine condition.

It is a very distinct, easily recognized species.

Food plant.—Orange.

Habitat.—Florida.

YPSOLOPHUS CARYÆFOLIELLUS, Chambers.

Ypsolophus caryæfoliella CHAMBERS, Can. Ent., IV, 1872, p. 224; Bull. U. S. Geol. Surv., IV, 1878, p. 166.

Ypsolophus caryæfoliellus RILEY, Smith's List Lep. Bor. Am., No. 5524, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5684, 1902.

A specimen in the U. S. National Museum determined by Lord Walsingham agrees well with Chambers' description (except that its alar expanse is 23 mm., not as Chambers' type, 21 mm.), and undoubtedly represents this species; it is from Miss Murtfeldt, Missouri. There is also a specimen from Texas (Beutenmüller). The species was described from Kentucky.

According to Chambers the larva is green, with six narrow, longitudinal, interrupted white lines; head ferruginous, first thoracic segment brown, thoracic feet black. At maturity it becomes white, suffused with pink, and with the longitudinal lines deep pink.

Food plant.—*Carya alba*.

YPSOLOPHUS VENTRELLUS Fitch.

- Chaetochilus ventrellus* FITCH, Trans. N. Y. State Agr. Soc., XIII, 1854, p. 234.
Ypsolophus ventrellus CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 167.—
RILEY, Smith's List Lep. Bor. Am., No. 5534, 1891.—BUSECK, Dyar's List.
Amer. Lep., No. 5685, 1902.
Ypsolophus unicipunctellus CLEMENS, Proc. Ent. Soc. Phila., II, 1860, p. 125;
Stainton Ed. Tin. N. Am., 1872, p. 229.—ZELLER, Verh. k. k. zool.-bot.
Gesell. Wien, XXIII, 1873, p. 286.—CHAMBERS, Bull. U. S. Geol. Surv.,
IV, 1878, p. 167.—WALSINGHAM, Trans. Am. Ent. Soc. Phila., X, 1882,
p. 186.—RILEY, Smith's List Lep. Bor. Am., No. 5533, 1891.

Clemens' type of this species is lost, but in the U. S. National Museum are three specimens agreeing well with the description and determined as *unicipunctella* Clemens by Lord Walsingham, who has examined Clemens' type. These specimens undoubtedly represent Clemens' species; they are identical with Fitch's type of *ventrellus*, which was found with his large handwritten label in his collection now in U. S. National Museum.

There is also a series of bred specimens of this species. They bear the label of U. S. Department Agriculture, no. 242, and the following are Professor Riley's unpublished notes on the larva:

Found at Glenwood, Mo., folding up the leaves of the black oak in little tubes. Length, 0.60 of an inch. A striped white and black worm with a redbrown head and cervical shield. Considering the ground color as white, there is a black dorsal line, somewhat restricted at the joints, and on each side of the dorsum is another somewhat wavy line separated from a lateral broader one only by a fine white line. Outer edge along stigmata white and underneath black glaucous.

Piliferous spots above quite large, black with a white annulation; two of them situated in black wavy line and one on lateral black line just above stigmata. Stigmata small, with a smaller piliferous spot just below it and others on venter. First segment dark brown below cervical shield; second segment darker than the others, with a white anterior edge. Last two segments almost entirely black above, being sharply separated from anus and anal prolegs, which are of a very light yellow color. Feet black, abdominal prolegs same as venter. Single white hairs from each spot.

On June 2, one changed to chrysalis. The chrysalis is formed within the leaf, the caterpillar first lining it with white silk.

The chrysalis averages 0.38 inch in length, with the abdomen comparatively narrow and small compared with the anterior half, the extremity tapering to a single point, of normal color, but characterized especially by having about six pairs of little elevations on the dorsum just behind the thorax and three others on each side of them along the upper edge of the wing sheets. Moth issued June 15-22.

The notes continue:

Zeller says it is the same as a variable, often lighter brown-spotted species, which he has often received from Ohio.¹

This bred series shows the extremes of the different ground colors, which Zeller mentions and proves his assertion that the species is variable in ground color from a very light yellow brown to a dark purplish brown.

¹ Riley, Notebook, IV, pp. 29-30.

YPSOLOPHUS EUPATORIELLUS Chambers.

Ypsolophus eupatoriella CHAMBERS, Can. Ent., IV, 1872, p. 221.

Nothris eupatoriella CHAMBERS, Can. Ent., IX, 1877, p. 23; Bull. U. S. Geol. Surv., IV, 1878, p. 158.

Nothris dolabella ZELLER, Verh. k. k. zool.-bot. Gesell. Wien, XXIII, 1873, p. 288.

Nothris setosella WALSINGHAM (not Clemens), Trans. Ent. Soc. Phila., 1882, p. 188.—RILEY, Smith's List Lep. Bor. Am., No 5558, 1891.

Ypsolophus eupatoriellus BUSCK, Dyar's List Amer. Lep., No. 5686, 1902.

As explained previously (p. 911), it seems to me unwarranted to make *Trichotaphe setosella* Clemens a synonym of this species. Lord Walsingham, who made it so, did not have Clemens' type, but came to a conclusion from a specimen in C. T. Robinson's collection, labeled *setosella*. It seems more reasonable to believe this specimen wrongly labeled and to accept Clemens' word, that his *setosella* is a *Trichotaphe* species.

I have bred good series of the present species from *Eupatorium* in the District of Columbia, and in U. S. National Museum are besides specimens from the following localities: Florida (Dyar), Texas (Beutenmüller), Arizona (Schwarz), Kansas (Crevecoeur), New York (Banks), Virginia and Maryland (Busck).

The males of this species have an interesting secondary sexual character, which I have not noticed in any other Gelechiid, namely, a strong pencil of long yellow hairs on thorax just below costal base of fore wings. This pencil can be expanded into a whorl of hairs which envelops the eyes and base of the palpi as a veil.

If—what is to be presumed—this pencil in the male is thus expanded during courtship, the insect may indeed be said to have reached in this respect the standpoint of man, whom love makes blind.

The larva feeds in a leaf folded from the edge and pupates within the fold. When full grown it is about 15 mm. long, cylindrical, tapering slightly. Head polished, jet black, longer than wide, semihorizontal, mouth parts brownish. Width of head, 1 mm.

Thoracic shield polished black, straight in front, rounded posteriorly, twice as wide as long. The rest of the body is greenish white, turning at maturity to wine red with white veins; tubercles small, black, hairs short black, anal plate only slightly cornified, light brown. Legs normal, first thoracic feet black, the others whitish; abdominal prolegs with complete circle of small hooks.

Two generations, at least, are found in the locality of Washington, the imagoes issuing in July and late in September.

YPSOLOPHUS MALIFOLIELLUS Fitch.

Chastochilus malifoliellus FITCH, Trans. N. Y. State Agr. Soc., XIII, 1854, p. 231.

Ypsolophus malifoliellus CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 166.—RILEY, Smith's List Lep. Bor. Am., No. 5526, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5687, 1903.

I have not recognized this species, which, as Fitch himself surmised, very likely is only one of the many varieties of *ligulellus*.

There is in the U. S. National Museum, under type No. 469, a specimen (one forewing only!) recorded as collected by and received from Fitch as type of *malifoliella* and bearing a label presumably in Fitch's writing, "*Depressaria malifoliella*."

This forewing can not be made to agree with Fitch's description of *Ypsolophus malifoliellus*, and is probably the type of one of Fitch's many manuscript species. It is a wing of *Machimia tentoriferella* Clemens and has no connection with the present species.

YPSOLOPHUS QUERCIELLUS Chambers.

Ypsolophus querciella CHAMBERS, Can. Ent., IV, 1872, p. 223; Bull. U. S. Geol.

Surv., IV, 1878, p. 83; Journ. Cinn. Soc. Nat. Hist., II, 1880, p. 202, fig. 16.—

WALSINGHAM, Trans. Am. Ent. Soc. Phila., X, 1882, p. 186.

Ypsolophus quercicella CHAMBERS, Bull. U. S. Geol. Surv., IV, 1878, p. 167.

Ypsolophus querciellus RILEY, Smith's List Lep. Bor. Am., No. 5529, 1891.

Ypsolophus querciellus BUSCK, Dyar's List Amer. Lep., No. 5688, 1902.

The type of the species was lost and no authentic specimen is now in existence. Chambers suggested that it probably rather should be placed under *Depressaria*, but his delineation of the venation shows, if it can be relied upon, that it can not be a *Depressaria*, and provisionally, at least, it must be retained in *Ypsolophus*.

From the fact that it was bred from oak, and that a description, even if meager, was given of the larva, there is some hope of rediscovering the species in time.

Habitat.—Kentucky.

YPSOLOPHUS ROSEOCOSTELLUS Walsingham.

Ypsolophus roseocostellus WALSINGHAM, Trans. Am. Ent. Soc. Phila., X, 1882,

p. 185.—RILEY, Smith's List Lep. Bor. Am., No. 5530, 1891.—BUSCK, Dyar's

List Amer. Lep., No. 5689, 1902.

I am not acquainted with this species, which for some reason I failed to get notes on while in Amherst, where the type is found in Professor Fernald's collection.

In the U. S. National Museum is a specimen labeled in Walsingham's handwriting *Y. roseocostellus*, but there must be some mistake, as it does not agree with his description, and belongs to *Ypsolophus ventrellus* Fitch, a much larger and more broad-winged species.

YPSOLOPHUS BIMACULELLUS Chambers.

Nothris bimaculella CHAMBERS, Bull. U. S. Geol. Surv., III, 1877, p. 122; Journ.

Cinn. Soc. Nat. Hist., II, 1880, p. 184.—RILEY, Smith's List Lep. Bor. Am.,

No. 5535, 1891.

Ypsolophus bimaculellus BUSCK, Dyar's List Amer. Lep., No. 5690, 1902.

The type of this species is in the Cambridge Museum of Comparative Zoology, but it is in so miserable a condition that it can not be identified specifically. It is, however, a true *Ypsolophus*, as the description would indicate.

YPSOLOPHUS GRISSEELLUS Chambers.

Nothris grisseella CHAMBERS, Can. Ent., VI, 1874, p. 245; Bull. U. S. Geol. Surv., IV, 1878, p. 158.—RILEY, Smith's List Lep. Bor. Am., No. 5537, 1891.

Ypsolophus grisseellus BUSCK, Dyar's List Amer. Lep., No. 5691, 1902.

Described from a single specimen now not in existence.

I have not recognized the species from the description, and it must remain at present as a doubtful species.

YPSOLOPHUS RUSTICUS Walsingham.

Ypsolophus rusticus WALSINGHAM, Proc. Zool. Soc. Lond., 1891, p. 525; 1897, p. 86.—BUSCK, Dyar's List Amer. Lep., No. 5692, 1902.

This species was described from St. Vincent Island, West Indies, and was recorded by Lord Walsingham from Texas.

The slight differences, which Lord Walsingham pointed out, from *Ypsolophus touceyellus* (*Anarsia trimaculellus* Chambers), to which species Walsingham originally had referred his specimen, do hardly seem to hold, and likely it will be found synonymous with that species.

Until large bred series of Chambers' species is obtained and definite proof found to the opposite, *rusticus* must however be retained as a separate species.

Mr. J. Hardley Durrant wrote me (letter of May 10, 1901) about this species as follows:

We have one specimen named *Anarsia trimaculella* Chambers. It is in poor condition and is extremely similar to *Ypsolophus rusticus*. It appears, however, to belong to the genus *Begoë* Chambers=*Mulacotricha* Zeller. I might have thought that it was *rusticus*, with denuded palpi, but the shape of the wings seems different, and the male genitalia strongly suggest *Begoë*. The whole question hinges on whether the differences are constant. I gather that you [the writer] have not sufficient material to decide this, nor have we. It would therefore be wiser to leave them as distinct, with a note under each that if they varied they should be united, when naturally *rusticus* will stand. Meanwhile your new name for *trimaculellus* Chambers, is unobjectionable.

It seems highly probable that Lord Walsingham's supposed specimen of *Anarsia trimaculella* is the very similar *Gelechia trimaculella* Chambers, which is a *Trichotaphe* (*Begoë*) (p. 914), and not the present species, and consequently still more reasonable that *rusticus* is equal *touceyellus* (*trimaculella* Chambers), which name it eventually must suppress. But to avoid more confusion it is safest to retain the two names until comparison of specimens can be obtained.

ANARSIA Zeller.

Plate XXXII, fig. 37.

Anarsia ZELLER, Isis, 1839, p. 190.

Second joint of labial palpi with dense projecting tuft beneath; terminal joint in male very short, concealed; in female, long, exposed.

Forewings elongate pointed; 12 veins, 7 and 8 stalked, 6 out of base of 7. Hindwings as broad as forewings; apex pointed, termen slightly sinuate; 8 veins, 3 and 4 connate, 5 approximate to 4, 6 and 7 stalked.

Of the four species included under this genus in Riley's list, *trimaculella* has just been treated under *Ypsolophus* [p. 922], and *belfragesella* Chambers was found to be synonymous with *Leuce fuscocristatella* Chambers [p. 794]. One other of Chambers' species described under the generic name *Anarsia*, namely, *albapulvella*, has been found to be an Oecophorid equal to *Chimabache haustellata* Walsingham, now known under the name *Eumeyrickia trimaculella* Fitch,¹ consequently we can not be very confident about Chambers' understanding of the genus *Anarsia*, and his last species *suffusella*, type of which is lost and which has not been rediscovered as yet from his description, is retained in the present genus simply because it can not be placed anywhere else at the present time, but it will quite surely be found not to belong in this genus. I have, therefore, not made any table for the separation of this and the only true *Anarsia* of which we are sure in this country, *lineatella* Zeller.

ANARSIA LINEATELLA Zeller.

Anarsia lineatella ZELLER, Isis, 1839, p. 190.—STAUDINGER and REBEL, Cat. Lep. Eur., II, No. 2999, 1901.—CHAMBERS, Can. Ent., IV, 1872, p. 208; Bull. U. S. Geol. Surv., IV, 1878, p. 129.—RILEY, Smith's List Lep. Bor. Am., No. 5540, 1891.—DIETZ, Smith's List Ins. N. Jersey, 1900, p. 475.—BUSCK, Dyar's List Amer. Lep., No. 5693, 1902.

Anarsia pruniella CLEMENS, Proc. Acad. Nat. Sci. Phila., 1860, p. 169; Stainton Ed. N. Am. Tin., 1872, pp. 36, 128.—CHAMBERS, Can. Ent., IV, 1872, p. 208; Can. Ent., VI, 1874, p. 242.

This common insect is at times of some economic importance owing to the injury of its larva to peaches and plums. The most commonly observed damages is to the young shoots which the larva enters and kills, but the injury to the fruit itself is sometimes quite as aggravating, as in a case in the District of Columbia which was under the writer's observation in the summer of 1901, where the larvæ occurred in such numbers as to spoil for market purposes nearly the entire large crop of beautiful, nearly ripe peaches. In nearly every one was found the larva, which had eaten into the stone and left the adjoining parts tunnelled and filled with its unappetizing frass.

¹ Journ. N. Y. Ent. Soc., p. 94.

References to the large economic literature has not been attempted; they may be found in part in the comprehensive article on this insect by Mr. C. L. Marlatt.¹

ANARSIA SUFFUSELLA Chambers.

Anarsia suffusella CHAMBERS, Can. Ent., VI, 1874, p. 243; Bull. U. S. Geol. Surv., IV, 1878, p. 129.—RILEY, Smith's List Lep. Bor. Am., No 5541, 1891.—BUSCK, Dyar's List Amer. Lep., No. 5694, 1902.

This insect, which was described from Texas, will in my judgment be found to be a species of *Ypsolophus* when it is rediscovered.

No authentic material is existent and I have not recognized it as yet from Chambers' description.

EXPLANATION OF PLATES.

PLATE XXVIII.

	Page.
Fig. 1 Venation of <i>Metzneria lappella</i> Linnæus.....	774
1.* Head of <i>Metzneria lappella</i> Linnæus	774
2. Venation of <i>Paltodora tophella</i> Walsingham.....	780
2.* Head of <i>Paltodora tophella</i> Walsingham	780
3. Venation of <i>Sitotroga cerealella</i> Olivier.....	782
3.* Head of <i>Sitotroga cerealella</i> Olivier	782
4. Venation of <i>Autoneda plutella</i> Chambers.....	782
5. Venation of <i>Telphusa quinquecristatella</i> Chambers	785
6. Venation of <i>Agnippe biscolorella</i> Chambers.....	789
7. Venation of <i>Agnippe fuscopulvella</i> Chambers	790
8. Venation of <i>Nealyda bifidiellu</i> Dietz	791

PLATE XXIX

Fig. 9. Venation of <i>Chrysopora lingulicella</i> Clemens	792
10. Venation of <i>Leuce fuscocristatella</i> Chambers.....	794
10.* Head of <i>Leuce fuscocristatella</i> Chambers	794
11. Venation of <i>Aristotelia argentifera</i> Busck.....	800
11.* Head of <i>Aristotelia argentifera</i> Busck	800
12. Venation of <i>Helice pallidochrella</i> Chambers	804
13. Venation of <i>Eriippe leuconotu</i> Zeller	806
14. Venation of <i>Encordyleu atrupictella</i> Dietz	807
14.* Head of <i>Encordyleu atrupictella</i> Dietz.....	807
15. Venation of <i>Recurraria robinella</i> Fitch	812
16. Venation of <i>Trypanisma prudens</i> Clemens	815

PLATE XXX.

Fig. 17. Venation of <i>Epithestis attributella</i> Walker.....	817
18. Venation of <i>Paralechia pinifoliella</i> Chambers	820
19. Venation of <i>Plutonium operrulella</i> Zeller	821
20. Venation of <i>Gnorimoschema gallaroliduginis</i> Riley	824
20.* Head of <i>Gnorimoschema gallaroliduginis</i> Riley	824
21. Venation of <i>Neodactylota snellenella</i> , male, Walsingham	836
22. Venation of <i>Neodactylota snellenella</i> , female, Walsingham	836

¹U. S. Dept. Agricult., Div. of Entom., Bull. 10, new series, 1898, p. 7.

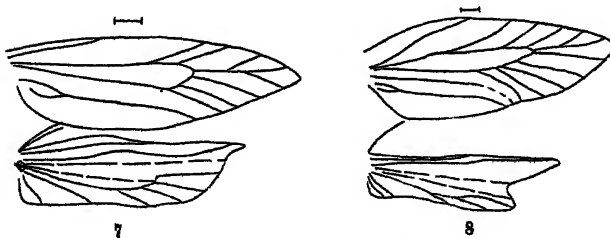
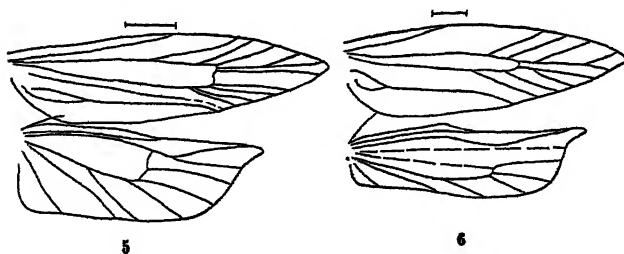
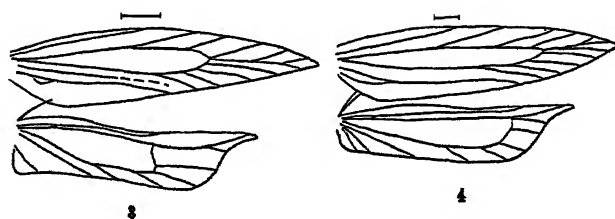
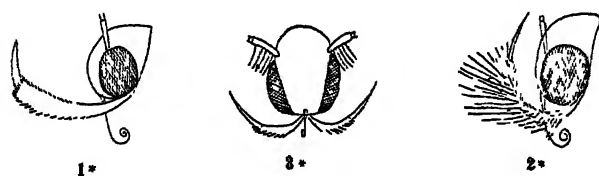
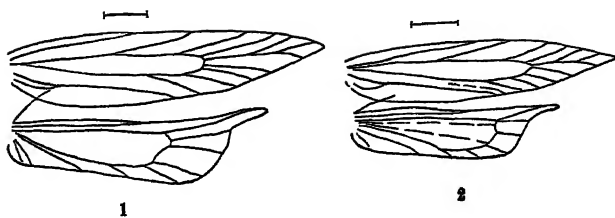
	Page
Fig. 23. Venation of <i>Neodactylota barberella</i> , male, Busck	836
24. Venation of <i>Deoclona yuccasella</i> Busck	837
24.* Head of <i>Deoclona yuccasella</i> Busck	837

PLATE XXXI.

Fig. 25. Venation of <i>Prostomeus brunneus</i> Busck	838
25.* Head of <i>Prostomeus brunneus</i> Busck	838
26. Venation of <i>Polyhymno acaciella</i> Busck	839
27. Venation of <i>Aprocarema palpiliniella</i> Chambers	841
28. Venation of <i>Anacampsis agrimoniella</i> Clemens	850
28.* Head of <i>Anacampsis agrimoniella</i> Clemens	850
29. Venation of <i>Gelechia serotinella</i> Busck	882
30. Venation of <i>Menesta melanella</i> Murtfeldt	903
31. Venation of <i>Strobisia irridipennella</i> Clemens	904
32. Venation of <i>Strobisia emblemella</i> Clemens	905

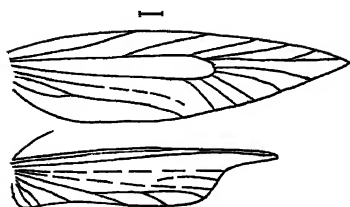
PLATE XXXII.

Fig. 33. Venation of <i>Trichotaphe serrativittella</i> Zeller	909
33.* Head of <i>Trichotaphe serrativittella</i> Zeller	909
34. Venation of <i>Glyphidocera æquepulsella</i> Chambers	917
34.* Basal joints of antennæ of <i>Glyphidocera æquepulsella</i> Chambers	917
35. Venation of <i>Anorthosia punctipennella</i> Clemens	918
35.* Head of <i>Anorthosia punctipennella</i> Clemens	918
36. Venation of <i>Ipsolophus ligatellus</i> Hübner	921
36.* Head of <i>Ipsolophus ligatellus</i> Hübner	921
37. Venation of <i>Anarsia liniatella</i> Zeller	928
37.* Head of <i>Anarsia liniatella</i> Zeller	928

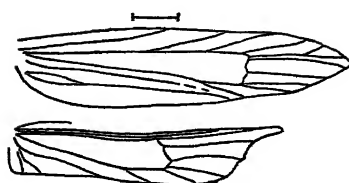


AMERICAN GELECHIID MOTHS.

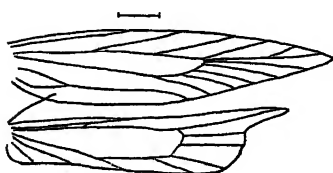
FOR EXPLANATION OF PLATE SEE PAGE 929.



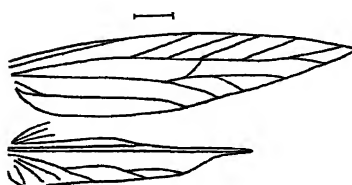
9



10



11



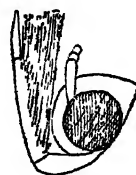
12



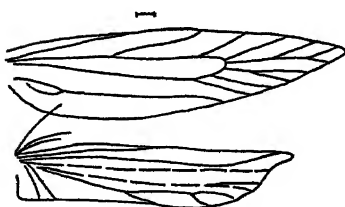
10*



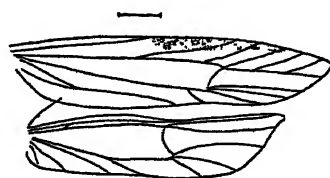
11*



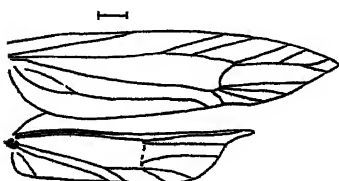
14*



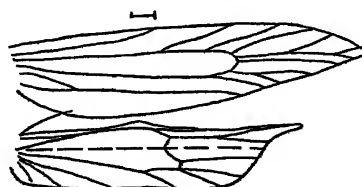
13



14

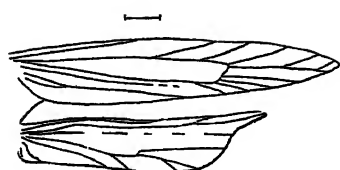


15

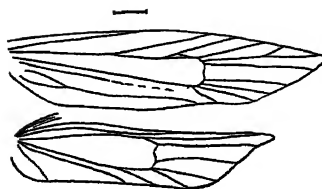


16

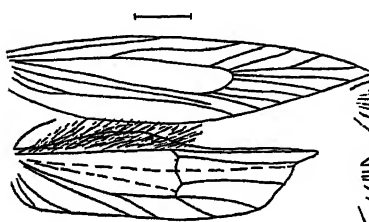
AMERICAN GELECHIID MOTHS.
FOR EXPLANATION OF PLATE SEE PAGE 929.



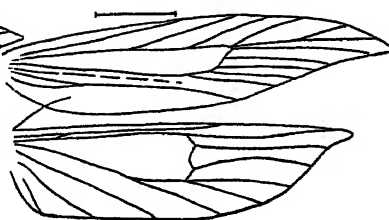
17



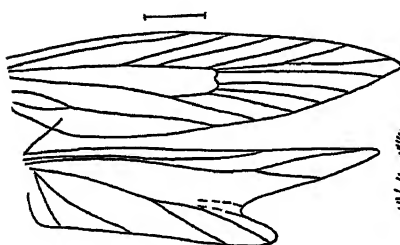
18



19



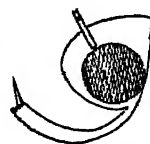
20



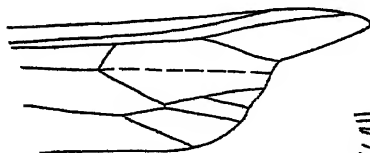
21



20*



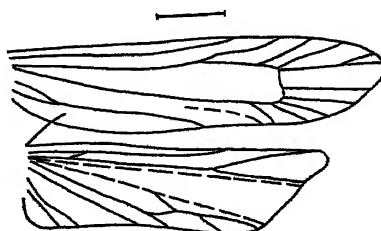
24*



22



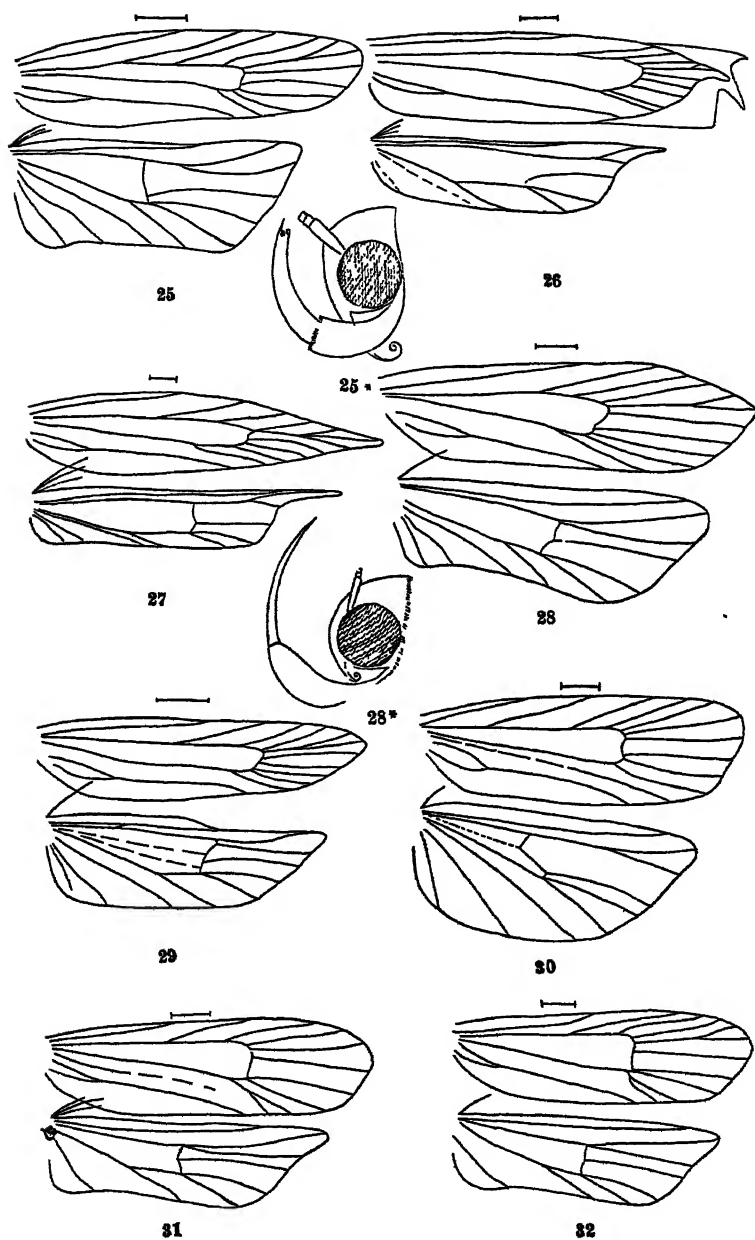
23



24

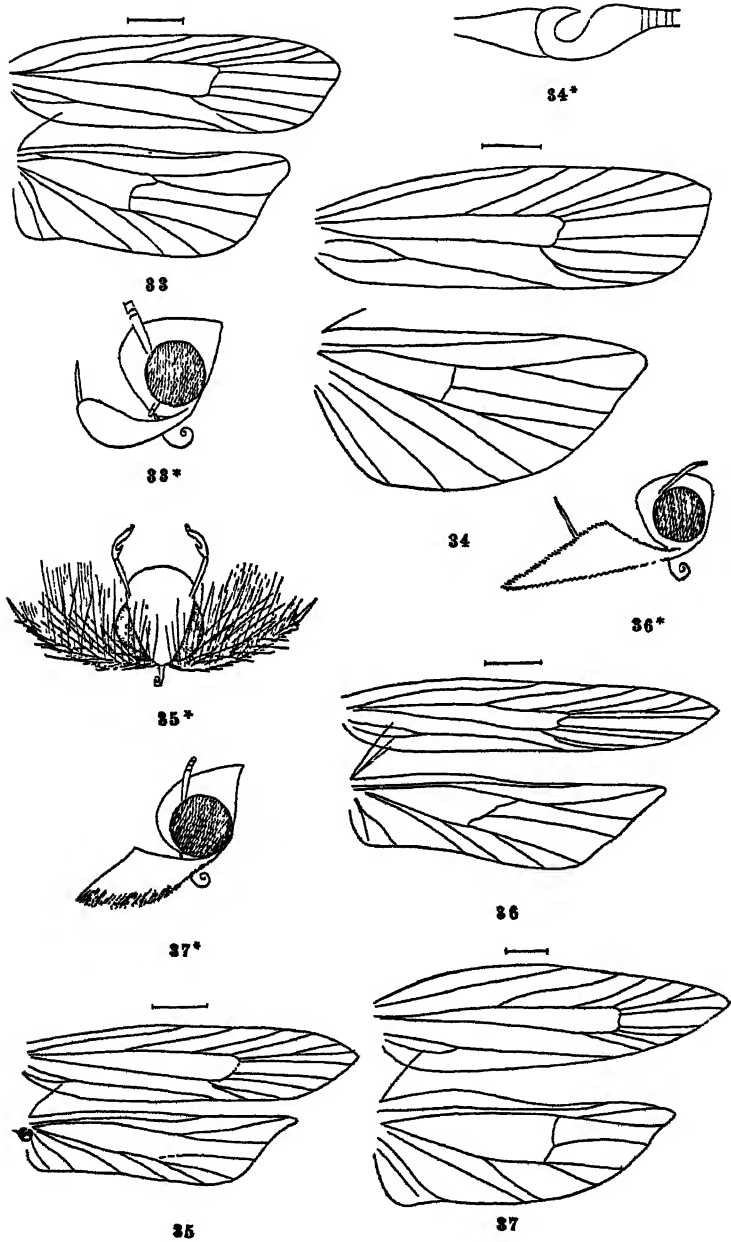
AMERICAN GELECHIID MOTHS.

FOR EXPLANATION OF PLATE SEE PAGES 929, 930.



AMERICAN GELECHIID MOTHS.

FOR EXPLANATION OF PLATE SEE PAGE 930.



AMERICAN GELECHIID MOTHS.

FOR EXPLANATION OF PLATE SEE PAGE 931.

SUPPLEMENT TO THE REVISION OF AMERICAN GELECHIIDÆ.

It is not surprising in a group of insects like the American *Tineina* that additions and corrections should become necessary soon after the publication of any paper on the subject. The reason for this is that, after many years of quiet in this group of little-known insects, active collecting and study is now being done by several workers. Each month brings much new material and many contributions to our knowledge, which shed light over hitherto obscure facts and permits a fuller comprehension of already described but imperfectly known species. At the same time, large numbers of new forms are discovered.

But these have not been the reasons that have led me to correct my paper before its publication. A very unexpected source of information has come to light in the discovery of the types of the late Brackenridge Clemens, in the Academy of Natural Sciences in Philadelphia. These types had been given up as lost, but were found a short time ago in an old-fashioned box, which had been put away in some out-of-the-way corner and forgotten. My delight in unearthing this gold mine for the student of American *Tineina* quite overshadowed my first very natural chagrin over the changes necessitated in my work.

In another paper I have given particulars of all the other types, but for the purposes of the present paper I shall use only the information gained about the *Gelechiidæ*.

Fortunately, as a whole, the new evidence substantiates my conclusions about Clemens' species. With one exception the only corrections made necessary concern those species, which were left by me as unrecognized, in the genus *Gelechia*.

TELPHUSA LONGIFASCIELLA Clemens.

Telphusa longifusciella Busck, Proc. U. S. Nat. Mus., XXV, p. 785.

Clemens' type No. 192 of *Gelechia longifusciella*, which is easily recognized, though lacking the head, proves the synonymy with Chambers' species and the generic position to have been correctly determined.

TELPHUSA FUSCOPUNCTELLA Clemens.

Gelechia fuscopunctella Busck, Proc. U. S. Nat. Mus., XXV, p. 895.

The type of *Gelechia fuscopunctella*, Clemens' No. 185, was found in good condition, though, like very many of his types, lacking the wings on the left side.

This type proves the species to belong to the above genus, very close to *Telphusa quercinigracella* Chambers.¹ It is easily mistaken for this species, especially if only flown specimens are at hand. I have, however, good series of both species bred from oak and have blown larvæ of both, and they are undoubtedly distinct. *Quercinigracella* has a darker ground color than *fuscopunctella* and has a distinct oblique dark fascia of raised scales at basal third of the wing, which is absent in *fuscopunctella*. Distinction can only be made with certainty between perfect specimens. When a little flown and rubbed the two species are extremely alike, and are also hard to separate from imperfect specimens of *Telphusa pulliderosucella* Chambers. The larvæ of the two species are equally easily mixed up, the more so as they both feed on oak in a similar manner, and both are found together in the District of Columbia.

Careful examination discloses certain constant differences. On the head, which in both species is yellow, *fuscopunctella* has two separate black eye marks on each side, while in *quercinigracella* they are connected and form a longitudinal line; the thoracic shield, which in both species is yellow, is in *fuscopunctella* marked with two central anterior and two larger posterior black spots, while in *quercinigracella* no anterior black marking is found, and the posterior ones are more lateral and more extended, forming a nearly complete black edge. The tubercles are very small, shining, black, and similarly placed in both species, but the hairs in *quercinigracella* are light, whitish, while in *fuscopunctella* they are dark. When mature, the larvæ of both species assume a conspicuous deep reddish coloration, with transverse whitish rings, but the whitish rings are on the middle of the segments in *fuscopunctella*, while in *quercinigracella* it is the intervals between the segments that remain white.

CHRYSOPORA LINGULASELLA Clemens.

Chrysopora lingulasella Busck, Proc. U. S. Nat. Mus., XXV, p. 792.

Clemens' type of *Nomia lingulasella*, No. 81, lacks the wings on the right side, but is easily recognizable and verifies my conception of the species.

ARISTOTELIA ROSEOSUFFUSELLA Clemens.

Aristotelia roseosuffusella Busck, Proc. U. S. Nat. Mus., XXV, p. 796.

Two types in good condition were found of *Gelechia roseosuffusella*, Clemens' No. 70.

These types can not be distinguished from the present conception of the species, but do not thereby remove the uncertainty shown by the writer to exist. Breeding of similar adults from the racemes of *Rhus*, together with careful notes on the larvæ, is still necessary to settle it.

¹ Busck, Proc. U. S. Nat. Mus., XXV, p. 781.

ARISTOTELIA RUBIDELLA Clemens.

Aristotelus rubidella Busck, Proc. U. S. Nat. Mus., XXV, p. 798

Clemens' type No. 72 of *Gelechia rubidella* is an *Aristotelus*, and confirms the present conception of the species.

ARISTOTELIA FUNGIVORELLA Clemens.

Aristotelus fungivorella Busck, Proc. U. S. Nat. Mus., XXV, p. 798.

Clemens' type Nos. 455-458 of *Gelechia fungivorella* is identical with my bred specimens. I have bred this species again last summer, and believe that the gall-feeding habit recorded by Clemens is merely accidental and that the larva normally feeds in folded leaves of willow.

The species is entirely distinct from the following:

ARISTOTELIA SALICIFUNGIELLA Clemens.

Aristotelus fungivorella Busck, Proc. U. S. Nat. Mus., XXV, p. 798.

One perfect type of *Gelechia salicifungiella*, Clemens' No. 459 was found in Philadelphia.

Before knowing this type I felt warranted in regarding this species as merely a variety of *Aristotelus fungivorella* according to Clemens' own suggestion. On the discovery of the type, however, it is at once evident that this assumption was erroneous. The type agrees well with Clemens' description and clearly represents a distinct species, easily separated from all described American species of the genus *Aristotelia* by its bright rust red ground color.

ARISTOTELIA GILVOLINIELLA Clemens.

Aristotelus gilvoliniella Busck, Proc. U. S. Nat. Mus., XXV, p. 803.

Clemens' type No. 189 of *Gelechia gilvoliniella* is identical with specimens regarded by the writer as this species.

ARISTOTELIA ANGUSTIPENNELLA Clemens.

Aristotelus kearfottella Busck, Proc. U. S. Nat. Mus., XXV, p. 803.

Gelechia angustipennella Busck, Proc. U. S. Nat. Mus., XXV, p. 891.

Clemens' type No. 194 of *Gelechia angustipennella* proves this species to be an *Aristotelia* and the species described by me as *kearfottella*.

I do not feel blameworthy that I did not recognize this species from Clemens' description. I compared his description repeatedly with this species and believe that the fault can justly be laid to the unsatisfactory description. The two dark dots near the costa at the base of the wing, mentioned by Clemens, are present, it is true, but are only part of the general dark color laid over the wing and should not be specially men-

tioned more than similar spots near the dorsal edge. The same is the case with the "oblique, short, dark fuscous streak." The special mention of these marks conveys the erroneous idea, that there are not any other similar marks. Moreover, the characteristic yellow costal streak at apical third and the entire apical ornamentation is not mentioned by Clemens, who had a flown specimen before him in which these markings were worn off.

RECURVARIA APICITRIPUNCTELLA Clemens.

Recurvaria apicitripunctella BRUCK, Proc. U. S. Nat. Mus., XXV, p. 808.

Clemens' type No. 77 of *Evagora apicitripunctella* lacks the wings on the right side, but is otherwise in perfect condition and proves my determination of the species to have been correct. It is the small ochereous species described later by Packard as *Gelechia abietisella*,¹ not as determined by Lord Walsingham, the larger, darker fuscous species described by Zeller as *Gelechia gilvoscopella*.²

TRYPANISMA PRUDENS Clemens.

Trypanisma prudens BRUCK, Proc. U. S. Nat. Mus., XXV, p. 815.

Clemens' type No. 82 of this species is like my bred specimens, thus confirming the present conception.

EPITHECTIS SUBSIMELLA Clemens.

Epitheatia subsimella BRUCK, Proc. U. S. Nat. Mus., XXV, p. 819.

The head and thorax are all that there is left of the type of *Parusia* ? *subsimella*, Clemens' No. 98, and they are not in sufficiently good condition to definitely determine the species.

The fragments, however, agree with the corresponding parts of the specimen which I determined as this species, and in the absence of further light this must be accepted as representing the species, which I feel confident it does.

EPITHECTIS GALLÆGENITELLA Clemens.

Epitheatia gallægenitella BRUCK, Proc. U. S. Nat. Mus., XXV, p. 819.

Clemens' type No. 229 of *Gelechia gallægenitella* is in good condition, though lacking the left wings. It confirms my identification of the species.

GNORIMOSCHEMA BRACKENRIDGIELLA Busck.

Gelechia brackenridgiella BRUCK, Proc. U. S. Nat. Mus., XXV, p. 894.

The type of *Gelechia detersella*, Clemens' No. 75, was found in good condition, though lacking the left wings.

¹ Rept. Dept. Agr., 1860, p. 150.

² Verh. zool-bot. Gesell., Wien, XXIII, 1873, p. 266.

It proves the species to belong to the genus *Gnorimoschema* Busck, and is very close to but distinct from *scutellariella* Chambers.¹ The differences are not apparent to the naked eye, but under the lens it is easily seen that the ground color in *detersella* is whitish overlaid with dark fuscous, each scale being dark tipped, while in *scutellariella* the ground color is dark, with the scales tipped with bluish white. Moreover, *detersella* has three indistinct dark spots on the wings not found in *scutellariella*—on the middle of the cell, on at the end of the cell, and a third still less conspicuous on the fold; only the first of these is mentioned by Clemens. On the other hand *scutellariella* has very indistinct costal and dorsal whitish streaks at apical third not found in Clemens's species.

The removal of this species to *Gnorimoschema* may make the change of specific name questionable, but for the present I shall retain the new name.

APROÆREMA NIGRATOMELLA Clemens.

Aproærema nigratomella Busck, Proc. U. S. Nat. Mus., XXV, p. 843.

Clemens' type No. 187 of *Gelechia nigratomella* agrees with the present conception of the species, but his type No. 195 of *Gelechia apicilinella* is unfortunately lost, so that the synonymy of these species as determined by Professor Riley can not be sustained nor rejected. It must remain as settled by Professor Riley, though to my mind this synonymy seems doubtful.

ANACAMPSIS RHOIFRUCTELLA Clemens.

Anacampsis rhoifructella Busck, Proc. U. S. Nat. Mus., XXV, p. 845.

Clemens' type No. 71 of *Gelechia rhoifructella* substantiates my determination of this species.

ANACAMPSIS AGRIMONIELLA Clemens.

Anacampsis agrimoniella Busck, Proc. U. S. Nat. Mus., XXV, p. 850.

Clemens' type No. 68 of *Gelechia agrimoniella* proves the present conception of that species correct.

ANACAMPSIS LEVIPEDELLA Clemens.

Anacampsis levipedella Busck, Proc. U. S. Nat. Mus., XXV, p. 851.

Clemens' perfect type No. 182 of *Strobisia levipedella* is the same as specimens thus determined by the writer, and definitely proves that the species belongs to the present genus.

GELECHIA MEDIOFUSCELLA Clemens.

Gelechia mediofuscella Busck, Proc. U. S. Nat. Mus., XXV, p. 885.

Clemens' type No. 188 of this species proves Lord Walsingham's identification of this common form to be correct.

¹ Busck, Proc. U. S. Nat. Mus., XXV, p. 834.

GELECHIA GILVOMACULELLA Clemens.

Gelechia gilvomaculella Busck, Proc. U. S. Nat. Mus., XXV, p. 896.

The type of this species, Clemens' No. 290, proves it to be a true *Gelechia* and the same as *Gelechia viminimaculella* Chambers.¹ This name, therefore, must give way to the earlier one of Clemens. Specimens of this species compared with both Clemens' and Chambers' types are now in the U. S. National Museum.

GELECHIA PULLIFIMBRIELLA Clemens.

Gelechia pullifimbriella Busck, Proc. U. S. Nat. Mus., XXV, p. 900.

Clemens' type No. 191 of this species proves it to be a small, nearly unicolorous, dark fuscous *Gelechia*, unlike any other described species known to me. Clemens' description is accurate, but the discal spots he mentions are very indistinct and easily overlooked. Alar expanse, 12 mm.

GELECHIA BRUMELLA Clemens.

Gelechia brumella Busck, Proc. U. S. Nat. Mus., XXV, p. 893.

The type of this species, Clemens' No. 196, shows that the species belongs to *Gelechia*, and that it is nearest *Gelechia vermella* Murtfeldt.² It is, however, a larger species, with alar expanse of 20 mm., and it has a deeper brown ground color.

GELECHIA ORNATIFIMBRIELLA Clemens.

Gelechia ornatifimbriella Busck, Proc. U. S. Nat. Mus., XXV, p. 899.

Clemens' type No. 223 proves the species to be a true *Gelechia* and identical with Zeller's *Gelechia unctulella*,³ which name must be dropped for the earlier *ornatifimbriella*. Clemens' description is very poor, both imperfect and incorrect, and should not be relied on for identification of the species.

GELECHIA VIDUELLA Fabricius.

Gelechia labradoriella Busck, Proc. U. S. Nat. Mus., XXV, p. 897.

Type No. 186 of *Gelechia labradoriella* is in poor condition, but easily recognizable from Clemens' description. I can find no differences between it and authentic specimens of the European *Gelechia viduella* Fabricius, with which it was tentatively made a synonym in Staudinger and Rebels's Catalogue Lepidoptera Europe, No. 2618, 1901, and the species must be known by this much older name.

It is a striking species of the black and white marked group, and comes between *Gelechia lugubrella* Fabricius and *albitorrella* Zeller,

¹ Busck, Proc. U. S. Nat. Mus., XXV, p. 881.

² Idem., p. 884.

³ Idem., p. 878.

differing from the former by the white head and the triangular white costal spot between the two fasciæ, and from the latter by its dark thorax and straight outer fascia, as well as by the form of the costal spot.

GELECHIA PUNCTIFERELLA Clemens.

Gelechia punctiferella BUSCK, Proc. U. S. Nat. Mus., XXV, p. 900.

The undoubtedly authentic type of this species, Clemens' No. 193, agreeing minutely with his description, proves that the species does not belong to the family *Gelechiidae*, but that it is the same species which Zeller subsequently¹ described as *Hypatima subsemella*.

The generic determination of this species by Zeller may need correction, but as Lord Walsingham is working on a monograph of the *Blasiotasida* I shall leave this question to his judgment, and for the present retain the species in *Hypatima*. Clemens' earlier specific name, however, must replace *subsemella*.

GELECHIA FLEXURELLA Clemens.

Gelechia flexurella BUSCK, Proc. U. S. Nat. Mus., XXV, p. 895.

Clemens' types of this species No. 94 and 95, according to his list, are unfortunately lost, and the species remains unrecognized; provisionally retained in *Gelechia*.

GELECHIA MIMELLA Clemens.

Gelechia mimella BUSCK, Proc. U. S. Nat. Mus., XXV, p. 898.

The type of this species, Clemens' No. 96, is also lost, and the species remain in the same condition as the foregoing.

MENESTA TORTRICIFORMELLA Clemens.

Menesta tortriciformella BUSCK, Proc. U. S. Nat. Mus., XXV, p. 903.

Clemens' type No. 100 of this species proves the present conception correct.

STROBISIA IRRIDIPENNELLA Clemens.

Strobisia irridipennella BUSCK, Proc. U. S. Nat. Mus., XXV, p. 904.

Type No. 73 of this species verifies the present conception.

STROBISIA EMBLEMELLA Clemens.

Strobisia emblemella BUSCK, Proc. U. S. Nat. Mus., XXV, p. 905.

Type No. 74 of this species verifies the present conception.

TRICHOTAPHE FLAVOCOSTELLA Clemens.

Trichotaphe flavocostella BUSCK, Proc. U. S. Nat. Mus., XXV, p. 908.

Clemens' type No. 69 of *Gelechia flavocostella* confirms the present conception of the species.

¹Verh. k. k. zool-bot. Gesell. Wien, XXIII, 1873, p. 302.

TRICHOTAPHE ALACELLA Clemens.

Trichotaphe alacella Busck, Proc. U. S. Nat. Mus., XXV, p. 909.

Clemens' type No. 115 of this species confirms the present conception.

TRICHOTAPHE JUNCIDELLA Clemens.

Trichotaphe juncidella Busck, Proc. U. S. Nat. Mus., XXV, p. 910.

Clemens' type No. 79 verifies the present conception of this species.

TRICHOTAPHE SETOSELLA Clemens.

Trichotaphe setosella Busck, Proc. U. S. Nat. Mus., XXV, p. 911.

Clemens' type No. 78 of this species substantiates my contention against Lord Walsingham's determination and proves that it is rightly placed under *Trichotaphe*.

ANORTHOSIA PUNCTIPENNELLA Clemens.

Anorthosia punctipennella Busck, Proc. U. S. Nat. Mus., XXV, p. 918.

Clemens' type No. 66 of this species confirms the present conception.

YPSOLOPHUS LIGULELLUS Hübner.

Ypsolophus ligulellus Busck, Proc. U. S. Nat. Mus., XXV, p. 921.

Clemens' type No. 206 of *Ypsolophus pauciguttellus* verifies the synonymy with the above species, as determined by Lord Walsingham.

The type of *Ypsolophus flavivittellus* is lost, but there is no doubt of this species being the extreme variety of the same species.

YPSOLOPHUS PUNCTIDISCELLUS Clemens.

Ypsolophus punctidiscellus Busck, Proc. U. S. Nat. Mus., XXV, p. 922.

Clemens' type No. 205 confirms the present conception of this species.

ANARSIA LINEATELLA Zeller.

Anarsia lineatella Busck, Proc. U. S. Nat. Mus., XXV, p. 928.

Clemens' types, male and female, of *Anarsia pruniella*, Nos. 86, 87, confirms the present conception of this species as synonymous with the European *lineatella* Zeller.

S. 97 (Unbleached).

MFP-341 General-6862-A-(C-597)-20-8-36-8,000,000,

SMITHSONIAN INSTITUTION.
UNITED STATES NATIONAL MUSEUM.

CONTRIBUTION TO A MONOGRAPH OF THE IN-
SECTS OF THE ORDER THYSANOPTERA
INHABITING NORTH AMERICA.

BY

WARREN ELMER HINDS,
Of the Massachusetts Agricultural College

From the Proceedings of the United States National Museum, Vol XXVI, pages 79-242
(with Plates I-XI)

[No 1310.]



WASHINGTON:
GOVERNMENT PRINTING OFFICE,
1902.

CONTRIBUTION TO A MONOGRAPH OF THE INSECTS OF
THE ORDER THYSANOPTERA INHABITING NORTH
AMERICA.

By WARREN ELMER HINDS,
Of the Massachusetts Agricultural College.

INTRODUCTION.

Very little attention has been given to the Thysanoptera of North America. So far as I can learn, descriptions or names of only twenty-three species have thus far (June, 1902) been published, besides three which have been recognized as previously described from Europe. Of the twenty-six species thus known in this country, four at least are certainly unrecognizable (*Limothrips tritici* Packard, *Phlaothrips mali* Fitch, *P. caryæ* Fitch, *Thrips phylloeræ* Riley). Of the remaining twenty-two, six have been found identical with previously described species and therefore become synonyms—the large number is not surprising as many of the early descriptions are entirely too brief to insure positive identification. Therefore only sixteen species have hitherto been known to occur in this country. We may say that almost no systematic work has been done on the order in the United States, and, with the exception of a study of the "Thripidae of Iowa," by Miss Alice M. Beach, most of the descriptions are scattered through different publications. I have endeavored to collect and present here such important facts as have already been published relating to members of this order, together with the observations which I have been able to make. An attempt has been made to place the work upon a systematic basis, and in order to make the descriptions uniform, and thus comparative, all the existing types that it has been possible for me to see have been examined and redescribed. In all, thirty-seven species are thus treated in the systematic part of this paper. Other descriptions which it has not been possible for me to place are given together by themselves in the hope that some one more fortunate or skillful than myself may have material by which to identify them.

There are given herein descriptions of eighteen species which I believe to be new, all but two of them having been collected at Amherst, Massachusetts, and within a radius of 2 miles of the Massachusetts Agricultural College, but even this field has not yet been thoroughly collected. The abundance of new species obtained within such narrow limits shows us how very little has been done upon this order and therefore it will not be surprising, when more attention shall be given to these tiny insects by collectors, if this small order, which has been considered as insignificant in numbers as well as in the size of its individuals, should prove to be quite extensive in the number of its species. Of the new species described in this paper, a complete set of types has been deposited in the Massachusetts Agricultural College; a set of cotypes, so far as they exist, has been deposited in the United States National Museum; a third set of cotypes I have retained for my own use, and the remainder I have also deposited in the Massachusetts Agricultural College. The number of specimens from which the species has been described follows each description. Eleven of the thirteen previously described American species have been redescribed as have also a number which I believe have been previously described in Europe. Descriptions of early stages have been given where known and the authority therefor noted in each instance. It will be noticed that in all cases the description of the female precedes that of the male, or the latter may be wanting entirely. Among the Thysanoptera the females are much more abundant than the males and also more characteristic when both are known. For these reasons all of the descriptions are based mainly upon the female. It would be impossible to give a bibliography of the species of this country without including many references to European works. Therefore the bibliography is intended to include the literature of this order for the world rather than for North America alone. Each reference has been numbered so that it could be referred to by number when desired without repeating the whole title. Such references have been made by inserting the bibliographical number inclosed by a parenthesis where authority for a statement is referred to, thus, (I).

I desire here to acknowledge that I am under many obligations to those who have assisted in making this paper more complete by kindly loaning type specimens, without the examination of which the identification of several species could not have been certain. I should state that these types were not loaned to me directly, but to Prof. C. H. Fernald, who kindly took upon himself the responsibility for them, but as I have been the one to profit by them it gives me pleasure to express my thanks to Prof. J. H. Comstock, through whose kindness I was able to see the type of *Limothrips poaphagus*; to Prof. Herbert Osborn for the privilege of examining at my leisure his type of *Thrips*

striata; to Prof. C. P. Gillette for the loan of his supposed *Thrips striatus*; to Prof. H. E. Somers for sending the types of Miss Beach and Professor Osborn, with their kind permission, to Dr. Henry Uzel for the positive identification of *Thrips tabaci* with his *Thrips communis*, and finally to Dr. L. O. Howard and Mr. Theodore Pergande for giving me access to the material in the United States National Museum collection.

This paper forms the major portion of a thesis for the degree of doctor of philosophy at the Massachusetts Agricultural College, where it has been prepared under the supervision of Prof. Charles H. Fernald and Dr. Henry T. Fernald, who have charge of the work in the department of entomology. To both, for the many ways in which they have guided and encouraged me in the work of the past three years, I give my heartiest thanks.

HISTORY OF THYSANOPTERA.

These insects were first described by DeGeer in 1744, under the name *Physapus* (2). Linnæus ignored this name and placed the four species known to him in a genus which he called *Thrips*, locating it in the order Hemiptera, immediately after his genus *Coccus* (5). In 1806, C. Dumeril raised the group to the rank of a family, which he called *Vesitarses* or *Physapodes* but retained it in the order Hemiptera (44). C. F. Fallen (47), in 1814, changed the name of the family to "Thripsites," but did not change its ordinal position, and this name was retained by Newman (61) as the name of a "natural order," which, however, had only family value. In 1825, Latreille (50) used for them the names *Thripsides* and *Physapi*. A. H. Haliday, in 1836, published an extensive study of the British insects belonging to this group and concluded that they should be given the rank of an order, for which he proposed the name *Thysanoptera* (63). Probably about two years later, Burmeister (69) also gave them ordinal rank, with the name *Physapoda*, since which time most writers have adopted one or the other of these ordinal names. Those who adopt *Physapoda* appear to base their preference largely upon the priority of Dumeril's use of the name *Physapodes*, *Physopoda* (*Physapoda*) being a re-formation of the term. It does not, however, seem to the writer that this position can be sustained, as at that time there was no genus *Physopus*, DeGeer's name having no standing, as it was given before the tenth edition of *Systema Naturæ*.^a

It seems therefore that Haliday was the first to give the group the rank of an order and to apply thereto a properly formed ordinal name: *Thysanoptera*, from *θίσανος*, a tassel, and *πτερόν*, a wing. This basing of the name upon characters of the wings is in accord with general usage in the various orders of insects. I believe that *Thysan-*

^a See Canons V and XIII, A. O. U. Code, 1892.

optera can claim priority and correctness of formation and should therefore be adopted.

While the scientific name of the group has been subjected to so many changes, the most frequently used common name has persisted unchanged since the time of Linnaeus. It is nothing more or less than the name which he gave to the genus Thrips, and is now applied in the same form to any individual of the order. It is therefore incorrect to drop the "s" when referring to an individual, as is frequently done. Thrips is a Latin name derived from the Greek *Σφύψ*, meaning a wood-louse, and is in the singular number and masculine gender, as will be also all generic names of which it forms the termination.

Various other common names based upon two of the most striking characters of the group have also been used to a limited extent: Bladder feet (*Blasenfüsse* or *Vesitarses*), referring to the peculiar structure of the extremity of the leg, is appropriate and much used by German writers. Fringe-wings, from *Thysanoptera*, has also been used, but much more rarely.

SYSTEMATIC POSITION OF THYSANOPTERA.

The systematic position of this group has undergone unusual change since its establishment by Linnaeus. Working as he did upon the most striking superficial characters, Linnaeus recognized in Thrips certain affinities with the Hemiptera-Homoptera, in which order he placed them. About 1828 through the anatomical studies of Straus-Durchein and Latreille, sufficient evidence was obtained to lead Latreille to separate them from the Hemiptera and place them among the Orthoptera. By other writers they have been regarded as Pseudoneuroptera, but at the present time the general opinion is that they form an order by themselves.

So far as the writer can learn, the best work dealing with this question has been done by Jordan (309). His studies were made principally upon *Heliothrips dracæniæ* Heeger, representing the Terebrantia and *Phleothrips brunnea* Jordan, representing the Tubulifera, but many other species were also considered and his conclusions are based upon anatomical (both external and internal) and biological considerations. The following is a free translation of a portion of Jordan's conclusion.

In regard to the place of Physapoda, we must classify them according to their immersed germ band and their larval form in the line of the Orthoptera, Homoptera, Hemiptera, wherein they should be placed according to their anatomy and biology.

In habits the Physapoda, especially the larvæ, resemble small Cicadellinæ. The hypognathism of Thrips is found in such marked degree that the mouth cone comes to lie under the prothorax as in the case of Homoptera, especially Phytophthira. The number and position of the ocelli resembles the Orthoptera s. l. more than the Hemiptera, while the position of the antennæ is similar to that of the Orthoptera

and Aphidæ. In the structure of the mouthparts, the Physapoda are not as far removed from the Orthoptera as are the Rhynchota; the Physapod proboscis is of a type between the biting mouthparts of Orthoptera and the sucking mouth of the Rhynchota, by which it is not meant that the Homoptera have developed from our Physapoda. The biting mouth organs of the Orthoptera are here concealed by the transformation of the mandibles into piercing bristles and the growing together of the labrum with the maxillæ and labium, while the piercing bristles form a short tube to the sucking proboscis. In this respect the Physapoda should be considered as Rhynchota together with the Homoptera and Heteroptera.

Thrips have the free prothorax in common with the Orthoptera s. l. and the Rhynchota. The development of the meso and metathorax shows that at least the metasternum and mesosternum are nearly equal to those in the Orthoptera, while the absence of the metaphragma, which is always present in the Orthoptera, and the disappearance of the long metathoracic muscles which are not reduced there, bring Thrips into close connection with the Homoptera. The first ventral ring is maintained through the absence of the first ventral plate and the entrance of the dorsal plate into the thoracic covering in the Physapoda just as in many Orthoptera s. l., but a quite similar condition is also shown in the first abdominal segment of the Homopterous Psyllidæ, a sign that Orthopteroid characters may be retained even in genuine Rhynchota.

A reduction of the system of venation of the wing takes place in the Phytophthira as in the Physapoda, but not in the same degree in the Orthoptera s. l. The Physapod wing is a Phytophthiran wing in which the large spread is greatly reduced, as in the Pterophoridae, by the development of long fringes.

In regard to the concentrated nervous system, Thrips come very close to Rhynchota and are far removed from the Orthoptera, but in this connection it is worth noting that the aberrant Mallophaga, provided with biting mouth parts, also possess a concentrated nervous system. Aside from these doubtful cases, all other Orthoptera have a developed chain of ventral ganglia. The tracheal system of Thrips has the small number of three or four pairs of stigmata. We find the stigmata reduced usually in the breathing organs of holometabolous insects. Among the Rhynchota we find it as in the Coccidæ; all other Rhynchota and the Orthoptera are holopneustic. The alimentary canal of Physapoda is characterized by the possession of four malpighian vessels which occur in like manner in all Rhynchota with the exception of the Aphidæ which have none, and the Coccidæ which have two urinary organs. The Orthoptera have a large number of urinary tubes, with the exception of the Termitidæ and Psocidæ with six and the Mallophaga with four. The long, slender esophagus of Terebrantia which reaches even into the abdomen is found also in the Psyllidæ, the large loop of the midgut of Terebrantia is characteristic of many Homoptera, but in these the enlargement of the loop of the gut running back, takes place at the beginning of the midgut.

The male sexual apparatus, with its simple, often pear-shaped testes, resembles the Mallophaga about as much as the Phytophthira; the female organs, from the rosette arrangement of the ovarian tubes, resembles the tubes in the Rhynchota; the want of connective strands of the eggs with the germ area places the ovaries especially beside those of the Cicadellinæ. The genital armature of the Terebrantia is found in the Orthoptera and Phytophthira.

In anatomical respects, therefore, the Physapoda come nearer the Homoptera than the Orthoptera s. l. There is also a series of biological facts which strengthen still further the connection of these insects with the Homoptera. First, I would recall that the Physapoda with their nymph and pronymph stages, in which they take no nourishment, exhibit a very similar transformation to that which is known to take place in Coccid males. The parthenogenesis of Thrips is not Orthopteroid, but a method of reproduction which is peculiar chiefly to the Phytophthira. The frequent

occurrence of apterous species without rudiments of wings, the condition that one sex is so frequently winged while the other is wingless, that among the normally winged species there appear individuals with reduced wings, that the latter phenomenon occurs especially toward autumn; all these are occurrences which take place to a considerable degree in the Phytophthira.

The manner of nourishment of Thrips, their life in larval colonies, the rapid and successive development of each generation, the sucking of plant roots by the larvæ, the periodical swarming of multitudes of the winged species give to Thrips throughout an Aphid-like character.

Therefore we can not doubt that we must separate the Physapoda from the Orthoptera s. l., but we must still determine whether we may incorporate them into the Rhynchota. If we maintain the division of the insects into eight orders (Thysanura, Orthoptera s. l., Rhynchota, Neuroptera, Lepidoptera, Diptera, Hymenoptera, and Coleoptera) and include in these orders the aberrant Siphonaptera, Mallophaga, Strepsiptera, the first in the Diptera, the others in the Orthoptera and Coleoptera, then we must also consider the Physapoda as Rhynchota and divide the Rhynchota into Heteroptera, Homoptera, and Physapoda.

But if, according to Brauer's classification, we break up the conglomeration of the Orthoptera s. l. into several orders of insects equivalent to the well-defined Coleoptera, Hymenoptera, Lepidoptera, Diptera, and Neuroptera, and also consider the aberrant Siphonaptera as a single order, just as the Bryozoa, Echinorhyncha, etc., represent aberrant types of worms, then there is no necessity for destroying the unity of the type of the Rhynchota by the incorporation of the Physapoda, but we can erect for Thrips a new order, the phylogenetic value of which we find in that they have branched off from the line of the Orthoptera-Homoptera-Heteroptera where the Orthopteroid characters of the Homoptera are not entirely suppressed, and that they exhibit special mouth parts which morphologically still remain somewhat Orthopteroid, but functionally are quite Rhynchotoid. The Mallophaga with their Rhynchota-like nervous system and their four malpighian vessels must have branched off before the Physapoda. Their special connection with the Physapoda arises from the form of the tracheal stigmata in the development of the thorax in which the metanotum, as in the Physapoda, is larger than the mesonotum in contrast with all Rhynchota and Orthoptera. If we collect the Mallophaga, Psocidæ, and Termitidæ as Corrodentia with Brauer, then we must place Physapoda in the system between Corrodentia and Rhynchota.

COLLECTION OF THYSANOPTERA.

As the life habits of species of this order differ very greatly, the methods of collection must be varied according to the species. The majority of these insects are to be found in flowers, grass, etc.; many are found exclusively in turf or near the surface of the ground; others are taken most commonly under the bark of trees, on foliage, etc.

For the grass-inhabiting species, I have found a short-handled sweeping net, made of fine muslin, most serviceable. Other cloths may be used, but the texture must be considerably finer than that of cheese cloth or many of the smaller species can easily pass through it and escape. As a white background greatly facilitates the observation of these small creatures, the contents of the net may be carefully examined by slowly turning it inside out without emptying it or the net may be emptied and the contents be examined upon a sheet of white paper carried for the purpose. Small phials serve as convenient recep-

tacles for the collections from various plants or other sources and thus they may be kept separate if desired. The most convenient method yet found for catching these lively little animals is to moisten a fine camel's-hair brush and place it directly upon the escaping actively jumping or flying forms. Those that are more sluggish in their movements can be easily lifted upon the point of the brush and transferred to the phial, which may be stoppered with a cork or wad of cotton. A label giving such data as it is desired to preserve may be placed in the phial or attached to the outside and a bit of the food plant may well be placed inside with the insects. In this bottle they may be kept alive for some time, if it is not convenient to preserve them at once.

Uzel recommends for collection from flowers, inclosing the flower head, insects and all, in a four-cornered paper bag, folding the upper edge over twice and fastening with a pin. Flowers of only one sort should be placed in a bag. The contents of the bags are examined at home upon a sheet of white paper and the escaping creatures captured with the aid of a fine brush dipped in alcohol. In winter, dried flowers and grass stems yield many hibernating forms.

Tree-inhabiting species may be found by beating over a white surface, or foliage may be collected and sifted by means of a fine beetle sieve, which is a great convenience for this work. In this way may be found also many species inhabiting turf, moss, fallen foliage, or decaying bark. The sifting may be done directly over white paper or the siftings collected by means of a fine bag fastened around the sieve and examined at the collector's leisure at home. Some species are known to inhabit certain oak galls and probably other galls will be found to shelter other species. The gall is, as a rule, the work of some other insect which the Thrips has appropriated for its home, but in Australia some galls are said to be formed by the Thrips themselves. Both Uzel and Jordan state that many inhabit fungi, but I have not yet found any in such a location.

PRESERVATION AND MOUNTING.

Various methods of preserving these tiny insects have been tried. Being so small that it is impossible to study them without the aid of a compound microscope, the method has been sought for which would best preserve the natural form and color of the insect and the most satisfactory results have been obtained in the following simple way:

The specimens to be mounted, having been brought into the laboratory alive in small bottles, are quickly killed, and at the same time cleared, by dropping them directly into xylol in which they are left for about an hour. They may then be mounted directly in balsam dissolved in xylol without danger of cloudiness resulting from moisture in the insect body. The mounts are clear, natural colors are well preserved, and when dried they are permanent and always available

for study. Working with such small insects, it is difficult to arrange them satisfactorily upon the slide, but with patience and care this can be accomplished fairly well. The wings should be spread, and this condition has, as a rule, been most easily obtained by transferring the insect from the xylol to the center of a clean slide, and then teasing the wings out to the desired position by means of a fine bristle. The balsam is then placed on the cover and gently lowered onto the insect. As the balsam spreads it tends to carry out the wings, legs, and antennae so that they are in a position for study. It is a convenience in study to have two specimens on the same slide, one being dorsal, the other ventral side up. Specimens of different species should not be placed upon the same slide. If it is desired to keep a large number of duplicates, it is not, perhaps, advisable to mount them all in this way, as they can be fairly well preserved by placing the living insects directly in about 80 per cent alcohol. Alcohol is, however, liable, or even likely, to cause an abnormal distension of the body, especially with Tubulifera, and if some of these distended specimens are afterward mounted permanently for study it will be found that their general appearance has become so changed that the species is scarcely recognizable. For this reason I can recommend alcohol only for duplicates of well known species and never for undescribed material.

While balsam mounts, made as described, seem to be best for preserving the general natural appearance of the insect, mounts made in another way are more useful for study of the chitinous structure. Everything but the chitin is dissolved by allowing the specimen to macerate for from twenty-four to thirty-six hours in a cold 10 per cent solution of caustic potash, or by boiling for a few minutes in a little of the same solution. When thoroughly cleared the specimen may be mounted directly in glycerin, or washed in water, dehydrated in alcohol followed by xylol, and then mounted in balsam. Such mounts can be examined under high-power lenses and reveal many fine details of chitinous structure which can not be seen in ordinary mounts.

A few words in regard to glycerin mounts may save some one such disappointment and loss as my experience with them has caused me. During one summer quite a large number of mounts were made by placing the insect directly into glycerin contained in a low cell, made either of white zinc cement or hard glycerin jelly, the cover glass being carefully sealed on with the white zinc cement in each case. These mounts were beautifully clear at first and were placed aside for study during the winter. When examined again after a few months they were found to be ruined and worthless. Nearly every specimen was more or less thickly covered, especially around the spiracles and thin membranous areas, with dense clusters of white, needle-like

crystals, many of which were also floating through the glycerin. As a result these slides, containing most of the results of a summer's collecting, had to be thrown away. The exact composition of the crystals was not determined, but it is supposed that they were mostly phosphates which had been dissolved in the juices of the insect's body. As the juices were gradually drawn out, the phosphatic salts, not being soluble in the glycerin, were deposited as the white crystals.

There are still other objections to glycerin as a mounting medium for Thysanoptera, though it may be all right for other insects. The dark pigment of the eyes is frequently dissolved out by glycerin, and spreads all through the head, suffusing it with a dark color, which obscures all details in that region. Furthermore, glycerin does not preserve the tissues of the body for a very long time. They gradually go to pieces, the segments spread apart, and the mount becomes worthless in the course of a few years. Of course this objection to glycerin does apply to the mounting of chitin which has been cleared from all soft tissues by treatment with caustic potash solution, as chitin is unaffected by glycerin.

EXTERNAL ANATOMY.

INTEGUMENT.

Adult.—The chitinous skeleton of these insects is quite firm. The body wall is made up of strongly chitinized, rigid plates joined together by thin and very flexible membranes. The texture of the plates appears usually to be quite uniform in different parts of the same specimen. In the head, especially, several of them are so smoothly joined that no sutures are visible. The thin connecting membrane may be smooth and of a uniform thickness, or, as in many parts of the Tubulifera, it may show a peculiar structure in the nature of regular, distinct, very minute, plate-like thickenings, varying in form but often circular or hexagonal, giving a decidedly granular appearance to the area.

The chitin is frequently thrown into more or less distinct folds or ridges, most frequently transverse in direction, but often branching and running together to form a reticulated structure. The back of the head and the pronotum are most frequently marked in this way. Sometimes the ridges become very thick and pronounced, and form a regular network over the surface so conspicuous as to be of use in classification (*Heliothrips*, *Parthenothrips*, see Plate VI, fig. 64). This reticulation may extend over the whole outer surface of the body, legs, and even the fore wings, but always seems to be heaviest upon the head and pronotum. It is not known to occur in the *Æolothripidæ*, but is found in several species of *Thripidæ*, and I have discovered it in an undescribed species of *Phloeothripidæ*.

In certain parts of the body there are found invaginations of the chitinous, external skeleton serving as advantageous points for the attachment of muscles. These can best be seen on the meso and metasternal plates of winged species of Thripidae, and are darker than the plates in color. Many species show a narrow, transverse line across the second to seventh dorsal abdominal plates near the anterior edge of each. This dark line is caused by a chitinous, ridge-like thickening forming an arch on the inside of each of these plates.

The chitin of the skeleton is rarely entirely unpigmented. Pigmentation may take place in the cuticle itself, when the color is usually gray, yellow, brown, or black, or color may appear from pigments deposited in the hypodermis or fat-body. Such deposits are usually very irregular and of a yellow, red, or purple color. Pigments are frequently present in both places in the same individual. Metallic colors do not occur.

Larva.—The chitin of the larva is much less firm than that of the adult, and there is scarcely any differentiation in texture or structure between the plates and connecting membranes. The surface is not reticulated, but is usually considerably wrinkled transversely and roughened, though sometimes it is quite smooth.

Pigments are rarely present in the chitin of the larva, and when they do occur the colors seem to be limited to gray, yellow, or brown. Larvæ are usually of yellow or red color, but these colors are due to hypodermal or fat-body pigments, and to some extent, perhaps, to the body fluids.

Pupa.—The delicacy of the chitinous covering of the early stages can be seen during the period of transformation. It is then thin, smooth, and often shining. The cuticle forms a delicate sheath around the wings, antennæ, and legs, and toward the end of this stage can be plainly seen separated from the body of the inclosed adult.

Integumental appendages.—These are present in the form of hairs, bristles, or spines which are variously modified. They are frequently borne upon small warts or tubercles which can be most distinctly seen upon the cheeks of many Tubulifera. The membranes of the wings are thickly set with microscopic hairs, usually either darker than the membrane itself or sharing its color. In some species (*Sericothrips*, various species) the abdomen is also thickly set with microscopic hairs, giving it a sleek, velvety appearance, and whorls of similar minute hairs often mark the antennal segments. The posterior fringes of the wings are always composed of long slender hairs, usually more or less spiral or wavy in appearance and inserted either directly into the edge of the wing (Tubulifera) or attached by a joint to a fixed base upon the edge (Terebrantia). This joint allows of motion only in the plane of the wing and toward its tip; it facilitates the folding of the hairs into line with the edge of the wing when the latter is brought to rest.

In nearly all species numerous short, small spines are borne upon the various parts, especially upon the prothorax, legs, and antennæ. Larger and more conspicuous spines or bristles mark especially the exposed parts of the body such as the vertex of the head, the angles of the prothorax, the veins of the wings in the Terebrantia, and the last two or three segments of the abdomen. Special modifications of these larger spines are found in many adult Tubulifera in the form of hairs which have usually a slender shaft and at the tip are roundly knobbed or irregularly funnel-shaped, though sometimes they are short and cut off squarely at the tip where they are fully as large as at their base.

Larvæ and pupæ of both suborders, in many cases, bear such knobbed or funnel hairs which, when present in the pupæ, are even longer and more slender than in the larvæ. The spines in many cases are placed in quite regular segmental rows, both in transverse and longitudinal directions.

HEAD.

The form of the head is peculiar and extremely variable. (See figs. 4, 14, 27, 55, 93, 107, etc.) But while this variation is great between different species, the proportion of length to breadth in the same species is very constant. The different sclerites forming the head are so completely fused as to be indistinguishable and we can therefore designate the regions of the head only in a general way. The dorsal portion back of the eyes is called the occiput, that between the eyes and extending forward to the bases of the antennæ is the vertex, between the bases of the antennæ and the attachment of the mouth cone on the ventral side is the frons, while the sides of the head are called the cheeks (genæ of other orders). The usual appendages of the insect head are present and will be considered separately.

Antennæ.—These are inserted upon the extreme front of the head and stand quite closely together upon the front margin between the eyes. They are always much longer than the head and may be two or three times as long. The number of segments is a character of much importance in classification and varies from six to nine. The form of the segments ranges from cylindrical to almost spherical, and this character is also of importance in classification. The spines upon the segments become more numerous as the apex is approached, and on the intermediate segments are mostly borne upon the apical half of each. The *Æolothripidæ* lack the specialized form and arrangement of the spines which is found in *Thripidæ*; their antennæ are quite uniformly clothed with short hairs or bristles. In the *Thripidæ* this general hairiness is lost, except in those species having whorls of hairs around intermediate segments, while a few much longer and usually more conspicuous spines are developed. The antennal spines of *Phloeothripidæ* resemble in a general way those of *Thripidæ*. In both

these families certain spines seem to have undergone much modification and to have become specialized as sense organs of some particular sort. (See Plate XI, figs. 123, 124.) They are larger than the unspecialized spines, thin walled and almost transparent, and usually end in a blunt point. In some species they are quite prominent, but as a rule are inconspicuous and require a careful adjustment of the light to be clearly seen. They are always simple in Phlæothripidæ and are usually borne upon segments three to five, sometimes three to seven.

In the Thripidæ similar structures are found, but they have undergone even greater specialization in most cases. In a few genera (*Chirothrips*, *Limothrips*, *Aptinothrips*, and *Parthenothrips*) they are simple and stand singly, one to a segment, upon the outer angles of segments three, four, and sometimes five, and upon the inner side at about the middle of six. In most cases, however, it appears that two of these specialized spines have approached and united at their base, so that we find upon the upper side of segment three and the under side of four, near their tips, a peculiar crescentic organ having the same apparent structure as the specialized spines just described and borne upon a small stalk standing in a clear, membranous area. (Plate XI, fig. 123.) In some cases these organs are shaped much like the horns of cattle and are curved in two directions, being curved forward and also toward the axis of the antenna. The fifth segment sometimes bears a simple spine and another one is also well developed upon the inner side of the sixth. The function of these structures is uncertain, but they are usually called sense cones.

In the Eulothripidæ an entirely different type of sense organ is found, though the two may possibly have much the same function. Upon the underside of segments three and four are narrow, much elongated longitudinally, thin, membranous areas, situated upon the outer half of each segment and a very small round spot of similar structure is similarly placed near the tip of segment five. (Plate XI, fig. 122.) These membranous areas strongly suggest an auditory function, but this is, perhaps, only a possibility.

Abnormal antennæ are not uncommon, and one or both may be deformed. The most common variation is in the line of a reduction in the number of segments through the fusion of two or more of the apical ones. Such deformed antennæ may not be shorter than the normal ones, but there is usually some reduction in length. In one case, at least (*Aptinothrips rufus* var. *convulsiicornis*), there occurs a regular and apparently normal fusion of the two segments constituting the style of the typical form with the sixth segment (Plate V, figs. 53, 54), which in this case is considered as a varietal distinction. An increase in the number of segments above the normal, by a division of one or more, is not known.

The antennæ are carried extended forward in front of the head, and

are not normally laid back along the body when at rest. In the Terebrantia the first two segments are usually markedly broader than the others.

Larval antennæ vary considerably from those of adults. The number of segments is constantly smaller, and the form is generally changed. Sense cones are not present, and the arrangement of spines is quite different from that in the adult.

ORGANS OF VISION.

Eyes.—Adult Thrips possess faceted eyes, which are borne upon the front angles of the head and extend downward onto the frons about as far as they do upward onto the vertex; rarely they are situated farther back upon the sides of the head, but still near the front. They are circular, oval, or reniform in outline. The size and number of facets varies considerably in different species, as does also the closeness of the facets to each other. The eyes are quite large, as compared with the size of the head, being together about one-half the width of the head through them. In many species, especially in Terebrantia, they are strongly protruding (*Heliothrips*, *Parthenothrips*). The individual facets are usually considerably swollen, and small hairs project from between them, thus giving the eye a peculiar resemblance to the surface of a raspberry. The cornea is quite thick, transparent, usually slightly tinged with yellow, and appears like a light-colored margin around the outside of the eye. The part of the head closely adjoining the eye is frequently also much lighter in color than the remainder of the head.

The pigmentation of the eye is dense and dark, so that, as a rule, by transmitted light the eye is entirely opaque, while by reflected light it may be red or very dark purple in color.

The eyes of larvæ are much smaller and simpler than those of the adults. They consist of but few large, separated facets, and are situated farther back upon the sides of the head.

Ocelli.—These are adult structures, and are not present in larvæ, though the pigment of the developing ocelli can sometimes be seen late in the larval stage. They are not always present, however, even in the adults. They are three in number, situated more or less closely together between the eyes on the vertex of the head, and are placed always in the form of a triangle, with its apex forward. Rarely only two ocelli are present, and it is then the front one which is wanting. Ocelli are present in all winged forms, and usually also in the short-winged forms of winged species. They are absent, however, in entirely wingless species.

MOUTH PARTS.

The mouth parts of Thrips are difficult to study, and so peculiarly modified that it has been found hard to determine their homologies.

This fact accounts largely for the many changes which have been made in the classification of this group. It is now generally admitted that their action is largely suctorial. They exhibit structures which seem to show a transition from a mandibulate to a haustellate form, and for this reason are of peculiar interest.

As a whole the mouth apparatus appears as a broad, unjointed cone attached to the extreme posterior edge of the under side of the head, being carried so far back that its attachment to the rest of the head lies largely under the pronotum (Plate X, fig. 111). The apex of the cone is usually quite sharp, but never as slender as in the Hemiptera, and lies, when at rest, in a depression of the prosternum between the fore coxae. In many species the mouth cone is bluntly rounded. In the Terebrantia it is attached to the frons by a strongly chitinated thickening, running more or less obliquely across the under side of the head. In most species this dark thickening is nearer the left eye than the right and is connected by a similar thickening with the margin of the left eye (Plate XI, fig. 120). This connection is wanting on the right side, though a portion of the thickening still remains close to the right eye. In the Tubulifera the base of the mouth cone is much more nearly symmetrical and the connections with the eyes are entirely wanting (Plate XI, fig. 127).

Asymmetry.—So far as we can learn, Prof. H. Garman was the first to call attention to the very peculiar asymmetry which is characteristic of the mouth parts of the members of this order, and he gave a new interpretation to certain of these parts, which we believe to be correct.

Not only is the connection of the mouth cone, as a whole, with the frons asymmetrical, but also some of the individual parts of the mouth are markedly so. The most striking of these are the form of the labrum and the absence of the right mandible. These parts will be considered more in detail by themselves.

Labrum.—The labrum forms the front wall of the cone (Plate XI, figs. 120, 127). It is decidedly asymmetrical in all Thysanoptera, but especially so in the Terebrantia. It is irregularly triangular in form, does not reach to the endocranial thickening, but is attached by its broad base to the clypeus by an indistinct membranous connection. From the base it narrows to the tip, where it is more or less rounded in Terebrantia, but is quite pointed and spine-like in many Tubulifera, though bluntly rounded in others. It is drawn out much farther toward the right cheek than toward the left, and on the right side also approaches most closely to the transverse thickening. The labrum is usually abruptly darker in color than the area between its base and the transverse thickening.

Maxillæ.—The maxillæ are broad, flat, and external. Like the labrum, they are wedge-shaped or triangular in general form, and they constitute the side walls of the mouth cone. They taper toward their

tips, where they are quite sharply pointed and strongly chitinized, and may reach slightly beyond the labrum. At about the middle point of the side of each maxilla is borne a two or three segmented palpus. In the *Æolothripidæ* this is always three segmented and geniculate; in the *Thripidæ* it is composed of two or three approximately equal segments and is straight, the segments being cylindrical but decreasing successively in diameter; in the *Phlæothripidæ* it is always two segmented and the segments are very unequal in length, the basal one being short and rounded while the second is long, slender, and cylindrical. The terminal segment is in all cases provided with a few touch bristles which are but rarely distinctly and easily visible.

Labium.—The labium is believed to be formed by the union of the second pair of maxillæ and in many insects evidence of this can be seen, but in the *Thysanoptera* there is no visible suture along the median line, though sometimes a deep median notch is present at the tip. It forms the hind wall of the mouth cone and is, as a rule, considerably broader at the tip than the other parts. In many species, of *Tubulifera* especially, it is very broad and heavy at the tip, but in others it is narrowed and the whole mouth cone is then usually elongated and pointed. Standing closely together, each upon a membranous space a little to one side of the middle of the tip, are the two or four segmented, cylindrical, labial palpi. The maximum number of segments is here found also in the *Æolothripidæ*, and the minimum number in the *Thripidæ* and *Phlæothripidæ*. Around the tips of the labial palpi are borne a few touch bristles similar to those upon the maxillary palpi.

Within the hollow cone formed by the parts just described lie the protrusile, piercing organs of the *Thysanopteran* mouth. These organs are three in number and of two kinds. Their homologies have been confused by various writers.

Mandible.—This is the large, unpaired, piercing spine lying on the left side in the mouth cavity. It has been variously interpreted as epipharynx, mouth spine, etc. In the right side of the head there is no trace, or but a mere vestige, of the corresponding organ. The absence of the right mandible appears to be closely correlated to all the asymmetry of the mouth parts of these insects. The mandible consists of two parts, though these are not separated in any way. The large bulbous base appears to be mostly muscular and is attached to the endocranial thickening behind the left eye close to the angle which is made by the endocranium at this point, and about in line with the branch from this thickening running to the left eye in *Terebrantia*, which branch thus appears to form a strong brace. On the right side the absence of this endocranial branch is doubtless due to the non-development of the right mandible, and the labrum has grown out farther on the right side to take the place in some measure of the

wanting structures. The muscular base is short and abruptly constricted, and from this point to the tip the mandible continues as a slender, strongly chitinized spine having a very sharp point. This structure is capable of protrusion for only about one-fourth of its length, and therefore appears to be used only for piercing the outer, tougher tissues of plants. The mandible in the Tubulifera is decidedly shorter and more bent than is that in the Terebrantia.

Maxillary lobes.—This pair of piercing organs has been considered by the majority of writers as the mandibles, but such they surely are not. Dissection shows that they are attached by a movable joint to the bases of the maxillæ. Each lobe is composed of two parts: A short basal, muscular arm or lever attached to the maxilla, and at the other end united to the enlarged, muscular base of the spine which is very slender and strongly chitinized. These spines are longer and more slender than the mandible and are developed alike on each side. When retracted into the mouth, the basal arm or lever extends obliquely forward so that the lever forms an acute angle with the spine, which then reaches just to the mouth, but when protruded the lever is brought down toward the mouth so as to straighten this joint, and the spine is thus thrust out from the mouth opening to a considerable distance. As these spines are more slender and protrude farther from the mouth than does the mandible, it appears probable that the latter is used to start the puncture through the hard, tough outer tissues, while the weaker lobes of the maxillæ, penetrating deeper through this opening, reach into the inner tissues. Some writers have stated that the three spines are hollow and used as suction tubes, but I have not found this to be the case in the species examined.

There is a marked difference in length of the maxillary lobes in the two suborders. In the Tubulifera they are extremely long, and when retracted curve far forward under the eyes, while in the Terebrantia the bend of the lobes scarcely reaches beyond the transverse thickening. In the Tubulifera these lobes are altogether longer than the entire head and can be protruded in many species as far as the hind edge of the mesosternum.

Other mouth structures.—Attached to the inner surface of the labium are certain other chitinized structures hard to describe and of uncertain homology, but considered by some as an hypopharynx.

Larva.—The mouth parts of the larva are much the same as those of the adult, though weaker and less strongly chitinized. The chitin of these structures is shed at each molt, and may then be seen connected with the cast-off skin.

Structure of mouth parts.—The parts forming the external wall of the mouth are not free, being united by a membranous connection across the interior. At the tip of the cone there is a small opening. It thus appears that, especially in the Tubulifera, these insects are incapable of biting or

chewing their food to any degree, though it has been stated that particles of leaf tissue have been detected in their excrement. This may be accounted for by the fact that the mouth parts are quite strongly chitinized at their tips, and so may serve, to some extent, to rasp or tear the tissues, small particles of which may be drawn into the alimentary canal with the sap.

THORAX.

(Plate XI, figs. 116-119, 125-127.)

The thorax is composed of three distinct segments, each of which is well developed. The prothorax is separated from the mesothorax by a deep constriction and is freely movable. The other thoracic segments are closely grown together and form what is conveniently called the pterothorax. The larval thorax shows no particular chitinized plates and its whole structure and the arrangement and development of the spines have been but little studied.

Most previous descriptions of the thoracic structure of these insects have been very brief. Unfortunately Dr. Uzel has given the entire anatomical part of his monograph in Hungarian, and therefore his description of the thorax has not been available. It is evident that there is considerable variation in the thoracic structures in different species, and it may be that when carefully worked out these parts will be found to have considerable importance in classification, whereas they have not been used in this way heretofore. A general description of the parts of the thorax is difficult to give and must be subject to much modification in many species as the homologies of some parts are not well established.

Prothorax.—This segment is as wide or wider than the head and varies much in its proportions and form. It is rarely much longer than wide, usually exceeds the mesothorax in length, and in most cases approximately equals the metathorax. The form in the Terebrantia is usually more or less rectangular, with the sides and hind edge especially somewhat rounded. This form is also found in some Tubulifera, but as a rule among them the thorax is trapezoidal, being much wider at the hind edge than at the front. This trapezoidal form appears to be closely related to the development of the fore legs, since in the genus *Chirothrips* where the fore legs are extremely thickened there is found the same form of prothorax as in the Tubuliferan genera where the fore femora are also enlarged.

The pronotum is strongly chitinized. In the Thripidae it is usually more or less transversely striated and often bears numerous small spines. In the other families it is generally smooth.

In most Thysanoptera the prothorax bears long conspicuous spines, the number and arrangement of which are much used in classification. These stand usually around the outside of the pronotum—one or two

at each angle and a pair on each of the transverse margins, and in some species one in the middle of each side. The maximum number is therefore twelve. When only one or two pairs are present they are at the hind angles. The form and size of these spines is also variable. They may be quite short and inconspicuous or nearly as long as the pronotum itself. In many Pléothripidæ they are knobbed or funnel shaped at the tips.

In a number of species of Tubulifera, a division of the pronotum into plates near the hind angles has been observed. Two triangular plates coming up from behind the middle on the side and at about the hind angles meet at a point considerably within the margin and above the fore coxæ. The prosternum is less strongly chitinized than the pronotum and at about the middle of the fore edge is often indented to accommodate the mouth cone. The insertions of the fore coxæ are at the hind angles and the distance between them depends upon the width of the hind edge of the prothorax. In some species the prosternum appears to be entirely membranous, while in others there are two small plates between the coxæ near the hind margin. The episternum and epimeron are more easily distinguishable in most Tubulifera than in Terebrantia.

Mesothorax.—The mesothorax is a broad, short segment, often the broadest of the body. The mesonotum is shorter than the mesosternum, though the latter approximately equals the metasternum as a rule, in consequence of which the division between the meso and metathoracic segments is oblique. The mesoscutum is usually a rather hexagonal plate, somewhat broader than long, and has thickened edges which are bent inward and used for the attachment of muscles, as is shown by cross sections of this region of the body. A narrow prescutum can be easily distinguished in some species, though in others it appears to be closely fused with the scutum. On each side of the scutum is a membranous area upon which the fore wings are inserted, at the bases of which there are chitinous thickenings for the attachment of muscles and also serving as pivotal points. A small, curved, triangular tegula is present in many, if not all, Terebrantia. Upon its broad edge, next the base of the wing, it is furnished, in *Æolothrips*, with a row of five or six small, stout spines which point directly toward the base of the wing, upon which, very near its base, there stands a somewhat larger, curved spine which, when the wings are extended in flight, points toward and would appear to engage some one of those upon the tegula. This is a peculiar and interesting structure the purpose of which can only be conjectured. In Thripidæ the tegula is present, but I have found no species having the spines fully developed, though little knobs or vestiges of such structures are present in some cases. The tegula is not always distinctly visible. At each anterior angle of the mesothorax there is a larger or smaller spiracle, which is

usually much elongated and narrow in Terebrantia, while in Tubulifera it is more rounded. In front of the spiracle a narrow plate extends up over the shoulder and meets the mesoscutum. This plate in some cases is only an upturned portion of the broad mesosternum, but in others is distinctly separated therefrom. This plate may be called the episternum, either separate or fused with the mesosternum. Behind the spiracle and below the attachment of the fore wings, there are one or two quite broad skeletal pieces which are rather triangular in shape. The mesosternum usually covers the whole ventral surface of the segment and its edges bend upward at the sides (e. g., *Heliothrips*, see Plate XI, fig. 119). In some species, however, it is an hexagonal plate similar to the mesoscutum and but little larger, while the episternal and epimeral plates are elongated and meet the sternum upon the ventral surface. Upon the median line of the sternum there is in all species, though very weak in the wingless ones, a quite deep chitinous invagination more or less forked and serving for the attachment of strong muscles (Plate XI, figs. 117, 119, 127). These endothoracic structures are plainly visible in most species. The middle legs are inserted far apart at the very hind angles of the mesosternum.

Metathorax.—This segment is usually slightly narrower than the preceding and generally tapers slightly to the base of the abdomen. Its dorsal plates are two, usually distinctly separated: a scutum and a scutellum. On each side of these a membranous strip continuing that from the mesothorax, extends backward to the base of the abdomen. The hind wings are attached quite close to the fore wings and in a similar manner. Near the bases of the hind wings lies in Tubulifera a very distinct rounded or oval spiracle. This spiracle is present and visible in many (Uzel says "all") Terebrantia, but I have been unable to find it in some species; in others it is extremely small and apparently functionless, while in still others it can be distinctly seen. The metasternum is broad and its edges curve upward around the sides of the body. At the front edge of this side lies a narrow triangular plate, the meta-episternum, while the meta-epimeron is here a narrow elongated plate lying above and close to the upturned edge of the sternum. The metasternum bears also a prominent endothoracic structure in the middle and the edges of the plates are often bent inward and thickened. The attachment of the abdomen is so oblique that the hind coxæ lie beneath the first abdominal segment. The hind coxæ are well separated and the sternum usually projects back between them as a distinct lobe or conical protuberance.

Variation in the structure of the pterothorax in wingless species.—The pterothorax is similar in both short and long winged individuals and we may expect to find at times long winged specimens of usually short winged species. In species which are entirely wingless, however, or in those one sex of which is always wingless, a marked variation in

the structure of the pterothorax is evident in the wingless individuals (Plate XI, fig. 125). The size of the pterothorax becomes greatly reduced in such cases as no great muscular development is needed to move the legs alone and the pterothorax is, perhaps, but little larger than the prothorax. The dorsal plates of both segments lose the usual form and become rectangular and transversely broadened, extending over the membranous space which is usually present along each side. No traces of wings are present and there is no longer any place for them. As a consequence of the decrease in musculature the endothoracic structures have become very much weaker, though still plainly visible.

APPENDAGES OF THE THORAX: LEGS.

The legs of Thrips are among their most characteristic structures and can hardly be mistaken for those of any other insects, whether short and powerfully thickened or long and slender. They are composed of the usual parts of the insect leg, which may be readily distinguished. The attachments to the thorax are quite far apart and at the very hind edge of each segment. The fore legs are often shorter and thicker than the others and more specialized.

Coxa.—This basal segment is large, usually subconical and quite freely movable. The fore coxæ, especially in Phlæothripidæ, often bear a few short, very stout, sharp spines and one long spine at the outside, but aside from these spines the coxæ exhibit little that seems to be worthy of note.

Trochanter.—This is a short, small segment between the coxa and the larger femur, its line of attachment with the latter being often considerably oblique.

Femur.—This, the first prominent segment of the leg, is quite long and more or less cylindrical or fusiform. The fore pair is frequently distinguished by much greater thickness than those of the other legs, (especially in Phlæothripidæ), the enlargement taking place in the upper side of the base and diminishing toward the outer end. In *Chirothrips* the lateral surface is strongly chitinized and bent backward somewhat at the tip so as to appear almost tooth-like at that point. In thickened femora, especially, the inner side toward the base is grooved to receive the base of the tibia when the latter is closed inward, and in a few species with this kind of femur the angles here have become sharply pointed and chitinized so as to form two sharp teeth at the tip (Plate VIII, figs. 89, 90).

Tibia.—The tibia is, as a rule, about as long as the femur and more nearly cylindrical or often club-shaped in form. It is most slender near its base where it is often slightly bent. At the extremity within, in a few species, the tibia bears an erect, stout, recurved hook or tooth as it is usually called.

Tarsus.—This is the most distinctive part of the leg. As a rule it is composed of two segments, though in larvæ and the fore tarsi of many species but one is present. The division between the two is oblique so that the under surface of the first segment is longer than the upper. Both segments are more or less cylindrical. The last segment terminates in a cup-shaped or hoof-like end which has been mistaken sometimes for a third tarsal segment. Upon the inner side of the fore tarsi are found structures which are nearly always characteristic of families. The Eolothripidæ, in both sexes and it is stated also in the pupal stage, bear upon the tarsus a peculiar hook-like structure the function of which is not understood. (See Plate I, fig. 9.) The finger-like hook is bent back upon itself, pointing toward the base of the tarsus and almost touches the point of a short, stout spine standing erect at its tip. In many species of Phlæothripidæ, though not in all, there is on the inner side of the tarsus a more or less stout tooth which stands nearly erect and is slightly recurved at its tip, and when this tooth is strongly developed, the tarsus, so far as is known, has only one segment. The development of this tooth seems also to be in proportion to the degree of development of the fore femur and its function appears to be to act as a hook in giving a firm hold and thus assisting the little creature in crawling through small places. Some Phlæothripidæ show no traces of such a tooth and all grades of development can be found in different members of this family. Both sexes usually possess such a tooth, though that of the male is sometimes much stouter than that of the female. In the Thripidæ the tarsi are simple, without either of these structures in nearly all species, only a few having a small tooth.

The tarsi are usually said to be clawless, but I do not consider this to be always the case, for some species have one and some two distinct, apparently movable claws on the sides near the end.

Spines.—Each segment of the leg may bear numerous spines, and some of these may be particularly well developed and worthy of note. In many Tubulifera there is upon the inner and lower side of the femur near its base a slender spine very much longer than any of the others. The hind tibia in most species of Thripidæ is furnished with a row of stout spines along the inner side and in many species a pair of similarly stout spines is borne at the tip of each tibia. Other specialized spines are sometimes found.

Bladder.—This structure, so remarkable and characteristic as to suggest the name Physopoda for the order, is protrusile from the end of the last tarsal segment. It is found in all species and in both adults and young, but its structure and action does not seem to be quite the same in the mature and immature stages.

As has been said, the end of the adult tarsus is cup-shaped. The wall of the cup is firm and in some parts, especially the underside,

strongly chitinized. Into the mouth of this cup is fitted a very delicate, protrusile, membranous lobe or bladder. When the foot is raised or at rest, the bladder is wholly withdrawn into the end segment and becomes invisible, as is the case in a majority of mounted specimens. The end of the tarsus is now blunt and flat and often seems to be minutely haired. The bladder is, however, always protruded and brought into action when the tarsus is put down or brought into contact with an object. The membrane is then pushed out and forms a lobe, larger in many cases than the cup portion which had previously wholly contained it. The mechanism of this complicated structure is very interesting but difficult to study. It has, however, been worked out, partially at least, by both Jordan and Uzel. The following paragraph on this point is gathered from Jordan's description and my own observations:

Bladder mechanism.—A strong chitinous rod, attached to muscles in the tibia, runs out through the tarsus and ends in the broadened, heavily chitinized under surface of the cup. The end of the plate is drawn out into weak cords running to the outer parts of the cup wall. Opposite the chitinous rod lies a double fork provided with a joint. The fork is cut short at a chitinous rod lying in the terminal segment of the tarsus and is movably joined thereto. Both arms of the fork are connected with the chitinous rod at their base by a tendon. Between the fork and the terminal plate of the chitinous rod the wall of the cup is usually thin and quite transparent, but in Phleothripidæ especially it is quite strongly chitinized and opaque. Looking down upon a foot that is inactive (bladder retracted) so that the chitinous rod lies along its middle line, the end appears more or less pear-shaped and small. Upon the surface lies the terminal enlargement of the rod, while the double fork occupies the sides. Between the tips of the fork the extremity appears folded in toward the middle. When the foot is brought into action the chitinous rod is drawn back somewhat, so that the attached fork is erected and spread out. The previously invisible bladder is now thrust out from the end of the tarsus. The ends of the fork and the chitinous rod continue into the bladder wall as fine rays. The bladder is elastic and very mobile, easily accommodating its shape to the surface upon which it rests. Looking at a larval tarsus from the side, the chitinous rod is seen to run obliquely from the middle of the tibia to the under wall of the cup. Here it appears to end suddenly without being broadened into a plate as in the adult; still the end of the rod is continued into the wall of the cup as fine rays. The dorsal part of the cup is occupied by a curved claw, the basal part of which is attached to a sort of bracket-like thickening of the wall of that part of the end segment at the base of the cup. Furthermore, the base of the claw is united to the chitinous rod by a sinew, and above the extremity of the claw the tarsus is drawn out into a membranous, longitudinally folded lobe. When viewed from

above, it is seen that the bases of the claws are strongly broadened within and somewhat less so without, and that the inner prolongations touch and are flexibly joined together. Both claws are supported upon the bracket-like ring at the base of the cup, while the folded membranous wall reaches beyond the claws. The chitinous rod unites near the support with the two tendons coming from the outer projections of the claws. When the bladder is brought into an active condition, the claws bend out from each other and the folded portion between them spreads out, while the distal portion, unseen in the inactive foot, becomes pushed out as the bladder. By a proximal pull upon the chitinous rod the tendons are drawn back and the claws thereby are spread out, moving around the bracket-like support with which they are connected as on a pivot. As the claws are grown together with the folded lobe, the lobe must be unfolded, but this does not explain how the membranous lobe can be protruded as a swollen bladder. If a swollen bladder be pricked or ruptured the blood pours out and the bladder collapses quickly. We must therefore conclude that blood pressure, acting with the mechanism just described, is largely instrumental in the protrusion of the bladders.

Other organs of doubtful function.—In the basal segment of the tarsus or the extremity of the tibia there has been found in a few European species a small, pear-shaped organ which has been considered as a gland, and some have thought this the structure which produced the swelling of the bladders, but as this supposed gland is much smaller than the bladder which it is supposed to fill, this can not be, and its function remains still problematical.

Near the line of union of the femur with the trochanter, Trybom has found in certain Phæothripidæ an organ or a group of organs which suggest to him the auditory organ on the base of the tibia in some Locustidæ. Trybom speaks of this structure as an elongated, thinly chitinized area, almost transparent. The areas are found on the side of the base of each femur near the line of its union with the trochanter. They are variable in shape and may be different on the opposite legs of the same pair. In each light area is a row of round structures having a dark point in the center of each.

These peculiar structures are small and easily overlooked, but Trybom has seen them in many species of Terebrantia as well as Tubulifera, and the writer has seen them in every species in his own collection. It appears, therefore, that they are always present, but as to their function we can only guess.

WINGS.

The wings of Thysanoptera are no less characteristic than are their feet. To be sure each character shown by them may be found in the wings of some other group of insects; nevertheless the combination of characters found here is unique. They are long, slender, membranous,

fringed, and not folded; they have few veins, and upon the hind edge of the base of each there is a usually distinct lobe or scale. The fore and hind wings are formed quite similarly. When at rest, the wings are folded back flat upon the abdomen, the fore wing covering the hind one completely and the pairs lying parallel in the Terebrantia, while in the Tubulifera the wings all overlap at their tips so that the full surface of only one can be seen when they are at rest. The wings are usually about as long as, though sometimes much longer than, the abdomen, but in many Tubulifera they are shorter. The wings of *Æolothripidæ* are proportionally the broadest in the order, being in the middle about one-seventh as broad as their length. Those of Thripidæ are much more slender, ranging from one-tenth in the fore wing of *Parthenothrips* to about one-twenty-sixth in that of some *Sericothrips*; the average in the species of this family known to me is about one-fifteenth. Three general types of wing are found in the order, each of which is characteristic of a family.

Family types.—*Æolothripidæ* possess wings which are comparatively broad, as we have seen. Their breadth continues nearly to their tips, where they are broadly rounded. (Plate I, fig. 2.) The hind wings resemble the fore wings closely in general outline and size.

The wings of Thripidæ are distinctly different from the preceding. Besides being much more slender, they taper from base to tip, where they are sharply pointed, the whole wing being usually slightly curved so as to be quite sabre-shaped. (Plate II, figs. 16, 23.) The fore wing of *Parthenothrips* approaches most closely that of *Æolothrips*, being broad and straight but pointed instead of rounded at the tip, and the venation is very different. The hind wings are somewhat shorter and narrower than the fore wings.

The third type of wing (Plate VII, fig. 75), found in the Phlæothripidæ, resembles that of *Æolothrips* in being broad and rounded at the end. The hind wing is also similar in size and form to the fore wing. In some species the wing is narrowed in the middle so that it resembles somewhat a shoe sole. Other characters, as venation, fringing, etc., separate them very decidedly from the *Æolothripidæ*.

Venation.—The venation is even more characteristic of the families than the form of the wings. In the *Æolothripidæ*, the fore wings show the most complex venation found in the order. They are entirely bounded by a strong ring vein and pierced by two longitudinal veins extending from the base to near the tip, where they bend outward and join the ring vein. Four or five cross veins are also present, two uniting each long vein with the ring vein at about the first and second thirds of the wing and one cross vein uniting the long veins before the middle. The hind wings have no fully developed veins.

In the Thripidæ the veins are much less prominent, except in *Parthenothrips*. One or two longitudinal veins are present, but cross veins have very nearly disappeared, though vestiges of most of those

found in *Eolothripidæ* can sometimes be observed in this family. The hind wings have always one longitudinal vein, but no ring or cross veins.

The wings of *Phlæothripidæ* are marked by the absence of veins. In both fore and hind wings alike there is but a partial development of one median longitudinal vein. This is quite strong and marked at the base, but rarely reaches to the middle of the wing before it disappears. There is no trace of a ring vein.

Fringing.—As a rule, fringes of long, slender hairs are borne upon both margins of the wing and so make up for the narrowness of the membrane. The hind fringe is always present, but the fore fringe is nearly absent in *Eolothripidæ*, always present in *Phlæothripidæ*, and more or less fully developed in *Thripidæ*. The front fringe consists of a single row of hairs which, when fully developed, are stouter in *Terebrantia* than those upon the hind edge, but in *Phlæothripidæ* they are similarly developed on both edges. In some *Thripidæ* the front fringe is vestigial, being very weak and sparse, or it may be entirely absent. On the hind wings the front fringes are more uniformly well developed than upon the fore wings, and both fringes are single. The hind fringe of the fore wing in *Terebrantia* consists of two rows of hairs so placed that they stand, when in flight, at different angles to the edge of the wing and thus by crossing give mutual support and form a mesh-work which is more strongly resistant to the air. The hind fringe hairs of both wings in *Terebrantia* are more or less wavy or spiral in form while those of the front fringes are straight, as are also both fringes in the *Tubulifera*. The hind fringes of both wings of *Tubulifera* are single except that near the end of the fore wing the fringe is double for a short distance. The length of the hind fringes is from two to seven times the breadth in the middle of the wing. Fringes are wanting near the base of the wings.

The method of insertion of the fringes differs in the suborders and is of interest. In the wings of *Tubulifera* the hairs are inserted directly for some distance into the membrane of the wing, where they gradually disappear. They are so flexible near the base that they can be bent back along the edge when the wings are folded at rest. In *Terebrantia*, however, the fringe hairs are borne upon small supporting bases on the edge of the wing and are in general stiffer than are those of *Phlæothripidæ*. One row of those upon the hind margin is attached differently from the other. The hairs stand upon small, conical, basal enlargements, to which they are attached by a joint so as to allow an easy folding of the long hairs toward the tip. Toward the base of the wing, however, the side of the somewhat conical support is drawn out into a point, which prevents the folding of the hairs toward the base and keeps them at nearly right angles to the edge of the wing during flight.

Spines upon wings.—In the Terebrantia the entire upper surface of the wing is thickly set with microscopic spines which are wanting in Tubulifera. Besides these there are usually borne along the longitudinal and costal veins some larger, prominent spines, which vary in number, size, and arrangement sufficiently to give in many species of the Thripidae characters of specific and generic value. Those borne upon the costa appear intermixed with the fringe hairs, though really they are not in the same plane. Their development seems to be in inverse proportion to that of the fringe, so that when the latter is strongly developed the costal spines are not larger than those upon the other veins, but when the fringe is weak or absent the costal spines develop greatly and to some extent replace it.

In Æolothripidae the spines upon the veins are always quite small, while the front fringe of the fore wing is wanting. In Phlæothripidae there are usually three stout, erect spines near the base of the vein in the fore wing.

Taking flight.—It has been frequently noticed and mentioned that many of these insects throw up the end of the abdomen, much as do the rove beetles (Staphylinidae), as though threatening to sting. This movement is made to assist in the proper spreading of the wings for flight. When at rest, the fringe hairs lie along the hind edges of the wings and are more or less interlaced. As the abdomen is raised, the wings are drawn down over its sides in such a manner as to make it appear that the spines upon the sides of the abdominal segments are used to some extent as a comb by means of which the hairs are straightened out and put in their proper position. This operation often has to be repeated several times before the wings are brought into a condition for successful flight. The power of springing, possessed by some species, also seems to be of assistance in taking flight. These statements apply only to Terebrantia, however, no observations having been made upon Tubulifera.

Coordination of the wings.—This is accomplished in a manner strongly suggestive of the Hymenoptera, though the structures concerned are less highly developed. Upon the costa of the hind wing, near its base, stand about five short spines in Terebrantia and two or three in Tubulifera, which are hooked at their tips. When the wings are spread in flight these tiny hooks engage a membranous fold on the underside of the scale of the fore wing. Beyond these small hooks stands a single stouter spine which also forms a hook. From the hind angle of the scale of the fore wing proceed two long, stout spines, standing so closely together as to often appear like one, and these engage the solitary stouter hook on the hind wing. Thus united the wings move together, but as the connection is so near the bases of the wings it can not be very strong.

Reduction of the wings.—It is an interesting fact that in this order

the wings may be fully developed, reduced to short pads not reaching beyond the thorax, or even entirely absent. Intermediate conditions are rare, though I have found a few specimens in which the wings were about one-half their normal length and entirely functionless. These three conditions may occur even in the same species (*Chirothrips manicatus* Haliday). When the wings are reduced, the little pads are rounded or oval in shape and are laid closely upon the thorax. The fore pad is larger, bears a few small spines, and covers the spineless hind pad completely. No fringes are present, but the fore pad has a distinct scale. Trybom, who has made quite an extensive study of this subject (425), recognizes eight classes into which these insects may be divided according to the varying conditions of the wings.

1. Both sexes entirely wingless.
2. Males and some of the females wingless.
3. Males entirely wingless, but females with normally developed wings.
4. Long winged and wingless individuals of both sexes occur.
5. Males and a majority of females with reduced, but a number of females with normally developed wings.
6. Both sexes always short winged.
7. Long winged as well as short winged individuals of both sexes occur.
8. Both sexes always long winged.

The appearance of a long winged generation following several which have short wings is strongly suggestive of a similar condition among the Aphidæ. In at least some species of Thysanoptera where this condition obtains the summer generations develop long wings while the fall generations are almost entirely short winged, so that nearly all the hibernating females have only wing pads. Long and short winged forms commonly alternate in the same sex, but short winged and entirely wingless forms of the same sex are not known. When only one sex is wingless it is the male. Wing pads are usually rather difficult to see, but their presence or absence can be deduced from the structure of the thorax, even though they are themselves invisible.

ABDOMEN.

The form of the abdomen varies from cylindrical to elongate-ovoid. In Terebrantia the segments are nearly cylindrical in cross section, while in Tubulifera the abdomen is flattened, giving the cross section an elliptical outline. The terminal segments especially are differently formed and characteristic of the suborders. The abdomen is always composed of ten segments, of which the second to the seventh, inclusive, are similarly formed in nearly all cases, while the others are variable and bear the most distinctive characters of the abdomen.

Terebrantia.—In the Terebrantia each segment except the first and the last three is composed of a broad dorsal plate reaching to the sides, a somewhat narrower ventral plate, and one or two very narrow plates on each side connecting these. Jordan states that one of the two pleural plates comes from the ventral, the other from the dorsal plate, but the dorsal pleural plate is sometimes wanting or indistinct. The dorsal plates of segments two to seven inclusive, are usually strengthened, especially in the Terebrantia, by a chitinous ridge along the inside somewhere in the anterior third, and this appears externally as a darker, narrow stripe on these segments. The first segment has a well-developed dorsal plate covering the hind part of the oblique metathorax, and small side plates are present in some cases, while the ventral plate is so short and small as to be easily overlooked. In the females the ventral and pleural plates are wanting upon segments nine and ten, the broad dorsal plate bending around the sides and approaching beneath to form the sheath for the ovipositor. In both sexes all the segments are similar except the last two or three, which in the females usually form a more or less sharp cone, while in the males, as a rule, the end is bluntly rounded; only a few species are formed alike in both sexes.

Spines.—Each segment bears, as a rule, but few spines, which are small upon the anterior segments, but increase in size and prominence posteriorly. These are most prominent upon the sides of the segments and especially around the last two, where they are called anal spines and are frequently very long and stout. In some species, as Quaintance has observed (454), these stout anal spines are the weapons of offense and defense.

Tubulifera.—In this suborder all but the first and the last one or two segments are formed alike. Each is composed of only a dorsal and a ventral plate joining at the sides by an indistinct suture. The ventral plate of the first segment is only slightly, if at all, developed, while the terminal segment appears to be a simple cylinder or tube and is formed alike in both sexes. The dorsal plate of the first segment, in some species, is drawn out anteriorly into a rounded projection, attaching to the metathorax, and on each side of the projection is a separate side plate. The arrangement and relative development of the lateral spines is much the same as in the Terebrantia. As a rule, upon the dorsal plates of segments two to seven inclusive, on each side at about one-fourth the cross diameter of the segment from the edge, there stands a pair of peculiar, inwardly bent, acute spines, and outside of these there is frequently a segmental row of much longer, straight, blunt spines. These dorsal spines appear to serve entirely for the confinement of the wings when at rest. The last segment bears at its tip a circlet of long, slender hairs, usually as long as, or longer than, the segment itself.

Stigmata.—Either three or four pairs of stigmata are present in Thysanoptera. In the adult they appear constantly at the anterior angles of the mesothorax, and on the sides of the first and eighth abdominal segments, while the fourth pair, always present in Tubulifera and sometimes distinguishable in Terebrantia as well, occurs close behind the attachment of the hind wings. Uzel states that four pairs of spiracles are present in the Terebrantia. This is surely often the case, but the metathoracic pair is very small, and in some species I can not find it, even in specially prepared mounts, and in some cases where traces of the stigma can be found, I am convinced that it is vestigial and really functionless. The mesothoracic stigma is frequently elongated dorso-ventrally, sometimes being very narrow.

In the larvæ the stigmata are situated at the front angles of the mesothorax and upon the sides of the second (instead of the first) and eighth abdominal segments.

The structure of a stigma is peculiar. In a surface view at the sharpest focus, upon an anterior abdominal stigma of, e. g., *Anaphothrips striatus*, cleared in caustic potash, the stigma appears to be made up of a number of irregularly polygonal, cell-like bodies, separated from each other by dark lines and each cell showing one or more dark spots near its center. In focusing down onto its surface, its appearance changes quite strikingly. As it first comes into view, though before it is clearly seen, it appears as a dark field with quite regular, small, light spots, the dark lines giving a reticulate appearance. When a little more nearly in focus, the cells appear dark, while the central spots and the intercellular lines and angles are very much lighter. Brought into sharp focus, the cells are seen to be more irregular than they appeared at first, the surface appears light colored, whereas formerly it appeared dark, while the intercellular lines and central spots have now become dark (Plate X, fig. 112.) This reversal of the light and dark parts is peculiar and very noticeable. On one side of the center a larger, rather indistinct, rounded area can usually be seen, which is the bulbous enlargement at the end of the trachea opening by a quite large orifice to the exterior. A cross view of a stigma (Plate X, fig. 113) shows a remarkable structure. The cellular areas are now found to be mushroom-like bodies with slender stalks, standing with their heads close together. These are quite strongly chitinized and dark. Whether the little air chambers between them connect in any way with the trachea has not yet been determined.

SEXUAL CHARACTERS: TEREBRANTIA.

Female ovipositor.—The most prominent external sexual character of the female is the ovipositor which is attached to the ventral side of the eighth and ninth abdominal segments (Plate XI, fig. 121) and is

plainly visible through the body of the insect. It is composed of four distinct plates or valves, two of which, forming the under or anterior pair, are attached to the very narrow ventral plate of the eighth segment and two, forming the upper or posterior pair, are attached to the sides of the ventrally extended dorsal plate of the ninth segment. The ovipositor as a whole is curved either upward (*Æolothripidae*) or downward (*Thripidae*) and terminates in a very slender, sharp point. The valves lie very closely together, but their inner surfaces are grooved, forming a passageway for the egg. The two plates on each side are fitted together in such a way as to slide back and forth upon each other without being displaced. The upper edge of the lower plate is grooved and into this groove fits a ridge or tongue formed by the lower edge of the upper plate. The upper edge of the upper plate, except at its base, is fitted with sharp, saw-like teeth pointing toward the base of the valve. The lower plate is provided with similar teeth on the under side of its distal third, while the middle third bears a number of peculiar, broad-cutting teeth. The ovipositor is movably connected with the abdomen by a number of small supporting plates or levers which also assist in its manipulation.

In at least two species of *Thripidae* known to me, the ovipositor does not appear to be functional though it is plainly present (*Chirothrips obesus* and *Thrips perplexus*).

When not in use, the ovipositor is drawn up close to the body and is received into, and entirely enveloped by, a membranous sheath along the last two segments which is made possible by the absence of the ventral plates at this place. The sexual opening is between the eighth and ninth segments in all Terebrantian females.

As a rule the conical form of the tip of the abdomen also indicates a female. In many of the light colored species, just in front of the base of the ovipositor, is a plainly visible internal organ which has sometimes been called the seminal receptacle. It usually appears as a small spherical or rounded body of an orange or brownish color, agreeing closely in this respect with the color of the spermaries of the males in species where males are known. This organ presents the same appearance, however, in certainly unfertilized females of bisexual species, and it is also always present, having the same size and color in several species known to me in which the males are extremely rare or possibly wanting altogether. Certainly a seminal receptacle can not be functional in parthenogenetic species, yet I have found this organ constantly present through eight or ten generations of a species bred in the laboratory where males were never produced.

Male.—Males are, as a rule, considerably smaller than the females. The abdomen is usually bluntly rounded at the end instead of sharply conical, though a few species resemble the females in this respect. The stoutest spines are usually at the sides of the ninth segment. In

Eolothripidae this segment is much larger than the others and is drawn out at its hind angles into hooks and processes which apparently assist in copulation. The sexual opening is between the ninth and tenth segments, and frequently from this point there protrudes more or less of the retracted copulatory apparatus, which is usually entirely drawn into the ninth segment through the walls of which it can be more or less distinctly seen. Three separate outer parts, which are strongly upcurved, can be seen proceeding from a complex basal part and the entire apparatus is protrusile. Within the abdomen the two elongated, irregularly pear-shaped, orange or brownish colored spermaries are plainly perceptible, lying usually in about the seventh and eighth segments. Upon the ventral surface of the second to the seventh abdominal segments, inclusive, in many species there are distinct rounded or transversely elliptical depressions found only in the males. Males are often lighter in color and quicker in movement than the females.

TUBULIFERA.

Female.—The sexual characters of Tubulifera are much less distinct and numerous than are those of the other suborder. The end of the abdomen is tubular and the sexual opening is between the ninth and tenth abdominal segments in both sexes. In this region are also found the strictly distinctive characters. In the female the basal edge of the tube is regular and entire. Near the hind edge of the ninth segment below there is a short, strongly chitinized rod (Plate X, fig. 115) which is dark and plainly visible in light colored species, but when the body at this point is nearly opaque, the rod can not be seen and the question of sex is often in doubt.

Male.—The male is usually smaller and more slender than the female, the sixth, seventh and eighth segments of the abdomen being noticeably narrower. The base of the tube is cut out below in the form of a semicircular notch (Plate X, fig. 114), which can usually be plainly seen except in very dark specimens, and through the opening formed by this notch the sexual apparatus can be protruded. The structure of this apparatus is much the same as in the *Terebrantia* and in light colored specimens it can be seen wholly retracted within the ninth segment. In some species this segment bears a broad scale at the base of the tube. In a few species the sixth segment bears on each side a thick, fleshy, unjointed appendage. The males in many species have more strongly thickened fore femora and stouter teeth upon the fore tarsi than do the females.

Copulation.—This I have rarely observed, and therefore the following statements are mainly gathered from Jordan's article (306).

In the Tubulifera the male rests upon the back of the female, and holding firmly to her thorax by his legs, he places the ventral surface of his abdomen along the side of the abdomen of the female and bends

the extremity under the abdomen of the female, so that the ventral surfaces of the last segments are toward each other. The copulatory apparatus of the male is then pushed out, while the female bends the tube upward so as to leave the sexual opening free. Copulation lasts for about half a minute, when the female begins to move and the male leaves her back, but the connection is not at once broken, and the stronger female drags the attached, struggling male behind her for some distance. One male fertilizes a number of females successively. In one case Jordan states that a male of *Phlaothrips brunnea* Jordan, in one-fourth of an hour, fertilized six females, and his spermaries were still about half filled.

In the Terebrantia the males are carried around upon the backs of the females and the union takes place in much the same manner as has just been described for the Tubulifera.

DEFORMITIES.

Slight deformities are by no means rare. The most common form consists in a reduction in the number of segments in one or both antennæ, brought about, in most cases, by the fusion of two or more segments at the end, though intermediate segments are sometimes wanting. It frequently happens that the antenna with fused segments is scarcely shorter than the normal one. Only very rarely does it appear that a reduction in number is the result of injury, though this would seem very possible. So far as is known, an increase over the normal number by a division of segments never takes place. Sometimes the wings are so deformed as to be useless. Deformities in the abdomen are very rare, but I have found two cases. One in which the posterior segments were constricted being abruptly smaller than the preceding, the other with a half segment wanting on the left side at about the middle of the abdomen. The right half of the segment was wedge-shaped, reaching in to the median dorsal line and giving the abdomen a corresponding crook at that point.

REPRODUCTION.

The method of reproduction in this group is of interest and also has an important bearing upon its distribution. So far as known, it is always oviparous and sexual, but two distinct forms are common in most species.

Bisexual reproduction.—This is the normal and most common form, but the two sexes are not found in anything like equal proportions, as females are almost always more abundant than males. This may be the case and reproduction yet be entirely bisexual, as in some species, perhaps in all, one male fertilizes a number of females. In a few species the males are found abundantly throughout the year; in others they are abundant only at certain seasons; in others males are rarely found at

any time; in still others, while the females are very abundant, males are unknown. The explanation for the relative scarcity or absence of males is found in the second method of generation.

Unisexual reproduction.—Parthenogenesis is the usual mode of reproduction in at least ten species, all Terebrantia, and probably occurs very frequently in many others, though positive statements can not be made upon this point until more extensive collecting has been done and life histories have become better known.^a

It seems that parthenogenesis must take place to some extent in those species in which the males are comparatively rare or are active for only a short season. However, no such thing as a regular alternation of generations, as in Aphidæ, is yet known to exist among Thysanoptera. In his studies of *Parthenothrips dracæne* Jordan found that the normal method of reproduction in warm greenhouses was unisexual, while on plants standing in a cool room an abundance of males was developed, and this condition lasted in the cool room throughout the winter season. The males of *Aptinothrips rufus* have been found only at hatching time, and then only very rarely.

DISSEMINATION.

It has already been noted that in most species there appear for some part of the season, in some generation or in one sex, individuals bearing fully developed wings, and we can not doubt that the wings play a large part in the distribution of the species. Certain it is that the power of flight is greater than would seem possible with such delicate wings as these insects possess. After harvest or toward autumn some species fly in large numbers, and in some instances have caused considerable annoyance by entering houses for hibernation. Winds may easily carry them for considerable distances, and when so scattered it is evident that their power of parthenogenetic reproduction is of great assistance in the establishment of the species in a new locality. Species living under the bark of trees growing upon the banks of streams are probably often carried for long distances on wood floating in the water, as some species which have been observed are found to endure a large degree of moisture and even submersion for some time without injury, and moist, decaying wood is their normal food. Species living upon cultivated plants, as in greenhouses, have doubtless been disseminated in commercial ways. Strange as it may seem, a species which is entirely wingless (*Aptinothrips rufus* Gmelin) is one of the most widely distributed. It is hard to believe that this species can have attained its present distribution in both Europe and America through the slow method of crawling.

^a Males of the following species included in this paper are rare or unknown: *Parthenothrips dracæne*, *Heliothrips haemorrhoidalis*, *Aptinothrips rufus*, *Anaphothrips strabus*, *Thrips tabaci*. Some others are too little known to be placed here.

Perhaps it may not be too much out of place here to speak more particularly of other movements aside from flying. The Tubulifera are very slow and deliberate in their movements, both in crawling and flying, and they never spring or run. Terebrantia vary in this respect, though in general they are much more active, and many run quite rapidly and take flight quickly. Some possess a power of springing which is well developed and often used in place of flight. The abdomen, head, and prothorax are raised and the little creature balances itself by its middle legs. Then suddenly the upraised parts are brought down together and the insect is thrown a considerable distance by the force of the contact.

DEVELOPMENT.

Oviposition.—As may be inferred from what has been said of the sexual apparatus of the two suborders, each has its own method of oviposition. The Terebrantian female cuts a slit with her saw through the epidermis and deposits her eggs singly in the tissue of the plant. The process of oviposition is as follows in *Anaphothrips striatus* and will doubtless hold in most points for the group:

The abdomen is raised somewhat and the ovipositor is let down from the sheath till it is nearly at right angles to the body. The abdomen is arched to bring the weight of the body to bear upon the slender saw, the valves of which are then moved back and forth upon each other by powerful muscles in the ninth segment. The toothed blades are gradually worked down somewhat obliquely into the tissue, and when the slit is sufficiently large there may be seen successive contractions of the abdomen as the egg is pushed out between the valves of the ovipositor and under the epidermis till it is nearly concealed. The entire operation requires about one and a half minutes, and upon its completion the female moves off a short distance to rest or feed. Occasionally the ovipositor becomes so firmly wedged in the plant as to hold its possessor prisoner for some time, frequently until death results (469).

I feel sure that *Thrips perplexus* and *Chirothrips obesus* will be found to deposit their eggs externally.

The number of eggs laid by a single female has been observed only in the case of *Anaphothrips striatus*, from a number of which an average of from 50 to 60 was obtained, the maximum average from a lot of 5 females being 72. These observations were made in the laboratory upon females confined in bottles. The percentage of eggs which hatched was also observed in this species and was found to vary in the laboratory from 35 to 40 per cent. It seems very probable that the artificial conditions under which these experiments were made must have in this case greatly reduced the percentage that hatched below the normal.

Tubulifera deposit their eggs externally, either singly or in groups, upon leaves and flowers or under bark, etc., according to their habitat. The period of oviposition in all species in this order is quite long.

Egg.—The eggs of Terebrantia are more or less elongated and slightly bean-shaped. They are colorless, delicate in structure, and no micropyle is apparent. The position of the eggs in a thin leaf is easily seen upon holding the leaf before a bright light, when they appear as brighter spots in the darker green tissue of the leaf. Eggs are laid in almost any green part of the plant, but not in the petals of flowers.

The eggs of Tubulifera are of an elongate-oval shape, attached with the long axis perpendicular to the surface, and have at the free end a thickening of the chorion with a micropyle in the middle. The eggs vary from yellow to brownish in color.

Embryology.—The development of the embryo can be observed in the translucent eggs of Terebrantia. Various writers agree in stating that the germ band is immersed. Before revolution the appendages of the embryo lie along the convex side of the egg, after revolution along the concave side. The length of the egg stage varies considerably in different species and, even within the same species, according to the weather conditions. So far as life histories are known, this stage appears to last from three to fifteen days in Terebrantia, but no record is found upon this point for the Tubulifera. The pigmented eyes of developing embryos are particularly prominent. If the egg bed dries the egg is quickly destroyed, but if moist, even though decaying, the development continues.

Emergence of the larva.—When ready to emerge, the young Terebrantian larva breaks through the tender chorion and pushes up through the slit in the epidermis made for the insertion of the egg. The larva works its way up till all but the tip of the abdomen is free, but remains supported by the tip in this upright position until the antennae and legs have separated from the body, to which they are at first closely applied, and have become sufficiently dried and hardened for use. It then falls forward onto its feet and is ready to travel or to feed almost immediately. No observations have been found on this point for the Tubulifera, but just as their eggs are laid singly or in groups, so also do we find the larvæ.

Larval stage.—The length of the larval stage varies with the species, and the statements recorded place it at from five to forty days.

When just hatched the head of the larva is very large in proportion to the body and the mouth parts are essentially like those of the adult. The thoracic segments are subequal. The abdomen is strongly contracted and very rough. As the larva grows the thorax and abdomen enlarge noticeably, while the head shows little change. In some species (*Heliothrips*) the abdomen becomes strongly distended and shining as though under considerable pressure, and a globule of fluid excre-

ment is frequently held by the hairs around the anus. The larvæ are less active than the adults and have no power of springing. The larval antenna always has fewer segments than the adult. In Phleothripidae the number is constantly seven. Thickened femora and tarsal hooks do not occur, the tarsus appears to be one segmented, and claws may or may not be present. The structure of the foot is much more distinct than in the adult. The eyes are not compound, but composed of a few separated facets, which are strongly elevated and always circular in outline. The number of facets increases in successive molts, but the circular form is retained. The rudiments of the ovipositor or genital apparatus appear on the under side of the eighth and ninth segments as indistinct lobes. The food habits of the larvæ are just as varied as are those of the adults, and some species are also found upon the roots of plants.

Molts.—From two to four molts appear to occur while in the larval stage, the last marking the change to the pupa. The chitinous covering of the internal mouth parts and of the bladders can be distinctly seen in the cast skin. When larvæ have become full grown they cease to feed, become restless, and seek some very secluded place in which to molt. In this search they are so successful that in many species pupæ are hard to find.

Nymph or Pupa.—The metamorphosis of Thysanoptera is peculiar, for though complete in many respects, it is much less so in others. Two stages are distinguishable while in the nymph condition. After the last larval molt, the insect still retains its larval appearance, the antennæ are extended, and the pro-nymph is moderately active. The wing pads are partially developed, extending to about the second abdominal segment, and the beginning of the formation of the adult appendages can be seen. After another molt, the true nymph stage is reached and the animal remains quiet unless disturbed, when it is capable of slight movement. No food is taken during this period. The antennæ are laid back upon the head and prothorax; their segmentation has become indistinct and the adult antenna can be seen within the nymphal skin. The number of facets in the eyes greatly increases, producing the adult condition. The legs are inclosed in loose sheaths and the wing pads reach to and from the sixth to the eighth segments. The pads extend obliquely outward along the sides of the body and do not cover each other. The fringes appear along the edges of the forming wings, the fore fringe being directed toward the tip and hind fringe toward the base of the wing. The forming lobes representing the ovipositor elongate, and those on each side overlap but remain separate. Within them develop the pointed valves of the adult ovipositor, which now extends to the tip of the abdomen. The development of the male genital apparatus takes place in a very similar way to that of the ovipositor of the female. The nymph stage

is passed in some secluded place, pupæ being found in the loose soil about the base of the plant, in the leaf sheath, or some similarly protected place, and many have been recorded as transforming in galls. When these changes have been completed, another molt takes place and the adult emerges.

The most noteworthy points in the metamorphosis may be summarized as follows: The larva resembles the adult in general form and in mouth parts; wings are developed in external sheaths; the transitional stage between larva and adult is quiet, and during it no nourishment is taken. The metamorphosis is therefore intermediate between complete and incomplete.

Hibernation.—Thysanoptera pass the winter in either larval, pupal, or adult stages. Many species, without doubt, hibernate in very nearly the same places in which they have fed. The bark-inhabiting forms remain in such places, together with many of the leaf forms which migrate onto the trunk. The dried stems of flowers and grasses shelter many species, while many of the leaf-inhabiting forms fall to the ground and are among those which may be found under fallen foliage, in moss, etc. Lichens and fungi shelter some as winter guests, while dead grass and turf contain many forms. It appears very probable that some of the larvæ which have been found upon the roots of plants were hibernating there rather than feeding thereon, as has been supposed.

The hibernating individuals appear to be able to withstand extreme degrees of cold and moisture. I have brought in a number of species gathered by pulling the frozen grass from bare mowings in midwinter after a temperature of -21° F. Upon being brought into a warm room, they very soon became active and ran about.

Thrips emerge from hibernation very early in the spring, and as soon as their normal food plants begin to grow most of them are in a condition to deposit eggs for a new generation, which in some cases in Massachusetts hatch during the latter part of April or the first of May.

Length of life.—Few observations have been recorded upon this point, but it seems improbable that even the longest lived exceed a single year. Among those species which produce several generations in a season, the hibernating individuals must live for at least seven months in the northern United States while the summer generations are much shorter lived. Their age however, as a rule, considerably exceeds the length of the life cycle, for oviposition is a slow process, and in *Anaphothrips striatus* is known to extend over a period of five or six weeks. As a result of this there is an indistinguishable overlapping of broods. I have kept a female of a midsummer generation of *A. striatus* confined in a bottle in the laboratory for almost five weeks. This species has eight or nine generations in a season, and may therefore be expected to be one of the shortest lived in summer.

ECONOMIC CONSIDERATIONS.

INJURIOUS FORMS.

Small and apparently insignificant though these insects are, they can not be disregarded from an economic standpoint. Only a few species, to be sure, must be considered as decidedly injurious, but these are widely spread and hard to control. Doubtless much damage, really caused by these tiny foes, has been attributed to more conspicuous but less injurious insects. The most important species in this country belong to the family Thripidae. The economic importance of each of these species is considered in connection with its description, but there are, however, some general points worthy of note which may be considered together here.

Feeding habits.—Thrips are found upon most flowering and some flowerless plants. The general mode of feeding is the same throughout the order. The green parts of the plant, chiefly, are punctured by the piercing mouth parts and the sap withdrawn therefrom by suction. The emptied plant cells become white and shriveled as they dry up and the insect, standing usually parallel to the veins of the leaf, moves on to fresh cells. The traces of their feeding are thus left in irregular streaks of dried, whitened cells. Behind them, as they feed, they leave rows of dots of dark colored excrement, which, it seems, have sometimes been mistaken for eggs.

On flowers Thrips are most abundant in summer. Burmeister states that the nectar of flowers furnishes them with nourishment, and Pergande has expressed a similar opinion (219); but this does not seem to me to be the case, as when present on flowers they are found sucking sap, not nectar. They feed to some extent upon the petals, but not so freely as upon the green parts. The inner surface of the sepals is a favorite place for feeding and oviposition. The essential parts of the flower come in for their part of the general attack and it is just here that the greatest injury to the plant is caused. Injury of this sort has been reported, especially upon strawberries by Quaintance (454), and upon apple and other fruit blossoms by Osborn (218, 223, 224), in which cases they caused so much injury to the styles by their punctures as to prevent fertilization and the setting of the fruit. (See *Euthrips tritici*, p. 152.) Probably *Euthrips tritici* and *Thrips tabaci* are guilty of most of such injuries. Mally has recorded a very similar injury to cotton bolls by an undetermined species of the family Thripidae (341). Many other flowers, though perhaps of less economic importance, are similarly attacked. Flower species feed also upon leaves.

On the leaves of plants and trees may be found a large variety of species, most of which feed mainly upon the under surface of the leaves, probably chiefly for protection from sun, rain, and enemies,

though it is also possible that more tender tissues may be an attraction. Such species avoid the light and, if a leaf be turned over, the insects will move around to the under side again. The constant sucking of myriads of larvæ and adults soon causes the feeding ground to wither, the leaf becomes encrusted with dead cells and dark colored spots of excrement and it is not long before its death results. Unless disturbed, most species do not travel much, and thus in time there appears to be something of a colony feeding around the place where the mother has fed and deposited her eggs. Though many plants thus suffer from the destruction of their leaves, the onion seems to be most severely afflicted. (See *Thrips tabaci*, p. 183.)

Grasses and cereals may be included in a third class in which the nature of the injury is somewhat different. Besides the abstraction of sap from the leaves of these plants, Thrips cause a greater injury by attacking the tender axial stems, thus cutting off directly the supply of sap to the head, which therefore fails to bear fruit and may be entirely killed. This is the way in which "Silver Top" is caused, and it is impossible to estimate with any degree of accuracy the damage which results to the hay crop. Besides working in this way, Thrips are charged with attacking directly the growing kernels of cereals. In the case of wheat, rye, oats, etc., they suck the nutritious milk directly from the growing kernels in the ear and produce an abortive condition of much, if not all, of the head, which is then called "pungled."

Greenhouse species appear to be becoming more numerous and more injurious each year. The principal injury here is done to the leaves, and nearly all kinds of greenhouse plants are subject to attack. *Thrips tabaci*, which has recently come into prominence, especially in cucumber and carnation houses, has an unusually wide range of food plants. It has already proved to be a serious pest, capable of the complete destruction of a crop, and is exceedingly difficult to control.

BENEFICIAL FORMS.

Predaceous Thrips.—The late B. D. Walsh once expressed the opinion that Thrips "are generally, if not universally, insectivorous, and that those that occur on the ears of the wheat, both in the United States and in Europe, are preying there upon the eggs or larvæ of the Wheat Midge (*Diplosis tritici*), and are consequently not the foes, as has been generally imagined, but the friends, of the farmer" (127 and 132). Such an opinion from so eminent an entomologist is likely to have some basis in fact, though we question whether his conclusion is even usually correct. Thrips have been frequently found in the galls caused by other insects, either with the makers of the galls or alone, and the conclusion has been drawn, though frequently, we suspect, without a direct observation to that effect, that the Thrips were preying upon the makers of the galls. Walsh also writes that he ~~has~~

"found Thrips preying upon the gall-making larvæ of more than twenty different galls, so that there is now no manner of doubt in my mind that Thrips is a true cannibal insect" (132). All recorded observations which I have seen seem to agree that such gall-frequenting forms belong to the Phlæothripidæ, and in very many of the cases noted it is said that they are in the pupal stage (123).

It seems to me entirely possible that in many cases their presence in the gall may be incidental, they having entered it for protection. It is impossible for Thrips to make for themselves an entrance into any closed gall, and when present in such it can only be after the exit of the gall maker or some parasite upon it, so here certainly the Thrips is not predaceous. Furthermore, it does not seem improbable from what we know of the food habits of the Tubulifera, which feed mainly upon leaves or decaying wood or fungi, that they may live peacefully in company with the true maker of an open gall which they can readily enter, finding there the same favorable conditions for abundant food and a secure retreat as does the gall maker. Phylloxera galls have often been found to contain Thrips, but the same doubt exists as to the real purpose of their being there. Walsh states that he has found six or seven red Thrips pupæ in nearly every gall of *Phylloxera caryocarpæ*. This observation shows plainly one object for which these insects seek out and enter galls, as a safe refuge during pupation, and this will account for the frequent presence of larvæ and adults in both inhabited open galls, as those of Phylloxera, and deserted closed galls, as those of Cynipidæ. It may be true that Thrips prey upon the gall makers, but further observations upon this point are desirable before we can fully accept that conclusion.

"*Thrips phylloxeræ*" of Riley's manuscript (one of the Phlæothripidæ) is said by him to "do more than any other species to keep the leaf-inhabiting grape Phylloxera within bounds" (163). A species of *Phlæothrips* has been observed destroying eggs of the Gypsy Moth (353).

Some species of Thripidæ have been observed feeding upon other insects and are undoubtedly beneficial. *Thrips 6-maculatus* has been repeatedly observed feeding upon "mites" or "red spiders," and other species have been said to do the same. Riley observed a Thrips larva feeding upon the eggs of the Curculio in Missouri (143a and 144). *Thrips trifasciatus* Ashmead is apparently predaceous and was observed feeding on the cotton Aleurodes (*Aleurodes gossypii*) in Mississippi (386). I have occasionally noticed that under the influence of confinement without plant food *Anaphothrips striatus*, which is certainly normally herbivorous, becomes cannibalistic and will feed upon its own species.

Flower fertilizers.—It is very probable that a few flowers, of which the "wild pansy" is one, are fertilized by Thrips, although such a relation must be exceptional. Few flowers are adapted to thus profit

by the presence of Thrips, as their action would tend almost entirely to self-fertilization of the flowers, which Nature does not generally approve. Therefore I believe that their value in this way must be very limited.

NATURAL CHECKS.

Insects and Acari, etc.—The most important insect enemy appears to be *Triphleps insidiosus* Say, which is very common on flowers and may often be found with a Thrips impaled upon its rostrum and held in the air while the captor sucks the juices from the body of its victim. The eggs of *Triphleps* are laid in a similar manner to those of Thrips and the larvæ of the former also prey upon the larvæ of the latter. The length of the life cycle of *Triphleps* is about the same as that of Thrips. *Megilla maculata* also devours Thrips in great numbers when both are abundant. *Chrysopa* and *Syrphus* larvæ have been found feeding upon the larvæ of *Thrips tabaci*. Heeger has recorded *Seymouria ater*, *Gyroneura munda*, and some fly larvæ as preying upon them, and Uzel has found *Triphleps minutus* also.

I have frequently found *Anaphothrips striatus* bearing one or more small, scarlet Acari (probably the larvæ of a *Trombidium*) attached to some membranous area of the body.

Both Uzel and Quaintance have found the eggs and adults of Nematode worms in the bodies of Thrips, Uzel recording over 200 worms from one specimen.

Plant parasites.—Thaxter (297) has taken *Empusa* (*Entomophthora*) *sphaerosperma* Fries from a species of Thrips which it was destroying in larval, pupal, and adult stages. Pettit has found in Michigan another parasite which he thinks will prove to be a Gregarinid (464). It was most abundant in the moist breeding cages, causing the insects to die and turn black. I have rarely found a fungus growing in a dead specimen which appears to be a species of *Macrosporium*, but it was not possible to tell whether the fungus caused the death of the insect or came in later.

Rain.—Of all the natural checks, none can compare in efficiency with a hard dashing rain. It has been noted that *Thrips tabaci* and *Anaphothrips striatus*, which become extremely abundant during hot, dry weather, disappear almost entirely as soon as the heavy showers of midsummer begin, and as long as such showers continue at frequent intervals the Thrips do not again become abundant. The same result will probably be found true in most outdoor leaf-inhabiting species.

ARTIFICIAL CHECKS.

These fall naturally into two groups, insecticides and cultural methods.

Insecticides.—So far as we know, no attempts to control Thrips by means of insecticides have been made outside the United States. Here

each of the three most important economic species, *Thrips tabaci*, *Euthrips tritici*, and *Amphothrips strintus*, has been experimented with considerably. Webster recommends, for *Thrips tabaci* in the field, spraying thoroughly with 1 pound of Standard whale-oil soap in 8 gallons of water (476), and he says also, "The grassy borders of ditches have been sprayed with kerosene with excellent results." Quaintance (454) tried many insecticides for *Thrips tabaci* and *Euthrips tritici* in Florida and found that "rose leaf insecticide"—1 pint in 8 gallons of water—killed from 65 to 70 per cent of the insects, and was the most successful of anything tested. For *Thrips tabaci* he recommends "whale-oil soap (Anchor brand), at the rate of 1 pound of soap to 4 gallons of water," or "rose leaf insecticide at the rate of 1 pint to 4 gallons of water."

Sprays must be very thoroughly applied to do even fair service, and ditches and margins around fields, as well as the ground between rows, should be treated also. Even with the most careful treatment many of the tiny insects will escape the spray, and the embedded eggs are entirely unharmed. Therefore, spraying, to be at all successful, must be repeated after a short interval. It must be admitted that at best spraying is an unsatisfactory remedy; still, it is perhaps the best method we know of at present for field work.

In greenhouses spraying may be more successful than in the field, but fumigation methods are here preferable. These also must be repeated in about a week to be successful. The most satisfactory results have here been obtained by the vaporization at night of 20 cc. of "Nikoteen" in 750 cc. of water for 5,000 cubic feet of space. This treatment did not injure the cucumber plants, while nearly all of the *Thrips tabaci* were killed (471).

Cultural methods.—These are undoubtedly too important to be neglected, even if insecticides be used, and in some cases they may prove even more efficient than the latter. For the Onion Thrips, Webster says: "All culls, tops, and other refuse of onion fields should be burned in the fall." He also recommends the burning of the grass along ditches and around the margins of the fields in winter or early spring to destroy the hibernating insects (476).

For the Grass Thrips it seems that cultural methods are the only ones that can be of any considerable help. A thorough burning of the old grass in early spring before growth begins destroys large numbers of hibernating insects—Thrips and many others. The attacks of the Grass Thrips are worst upon old, worn-out meadows, fields, and lawns, largely because *Poa pratensis* (June grass) is most common in such places. Infested grass should be cut as early as possible or fed green. So far as I can learn, the seed of June grass is sold only in lawn mixtures and is not used for field seeding, though it comes in naturally as the other stouter-growing species which are usually sown out. The appearance of a large amount of "Silver Top" is there-

fore a sign that the field is becoming exhausted. Such fields should be plowed, and it is advisable to plant with some cultivated crop for at least one season before re-seeding.

CHARACTERS OF THYSANOPTERA.

Small insects; length ranging from one-fiftieth to one-third of an inch. Wings usually present; four in number, long, narrow, membranous, never folded, with at most two longitudinal veins and few or no cross veins; hind margin always, front margin usually, fringed with long, slender hairs much exceeding in length the breadth of the membranous part of the wing; wings laid horizontally along the abdomen when at rest; wings sometimes reduced to short pads not reaching beyond the hind edge of the thorax and entirely absent in a few species.

Mouth parts intermediate in form between those of sucking and chewing insects, but probably used almost entirely for sucking; arranged in the form of a cone situated on under side of head and placed so far back that it lies almost entirely under the prothorax (see Plate X, fig. 111), and is more or less concealed from the side by the fore coxæ and femora. Mouth cone formed by the labrum, the broad, flat, triangular, external portion of the maxillæ bearing each a two or three segmented palpus, and the labium bearing two or four segmented palpi; these external parts grown together and not freely movable. Mouth always asymmetrical, only the left mandible being developed. Mandible and lobes of the maxillæ modified as internal, protrusile, bristle-like piercing organs.

Antennæ quite slender, six to nine segmented, situated closely together upon vertex of head. Ocelli always present when long wings are present, always absent in entirely wingless forms; usually present, sometimes absent, when wings are reduced to pads. Prothorax distinctly separated from mesothorax and freely movable. Meso and metathorax firmly and closely united; metanotum longer than mesonotum. Tarsi usually two but sometimes one segmented; the terminal segment fitted at the tip with a protrusile, bladder-like organ which can be withdrawn entirely within the segment so as to be invisible. Abdomen ten segmented. Terminal segment either conical or tubular. Three pairs of stigmata are always present and a fourth pair is found in all Tubulifera and many Terebrantia. In the adult these are situated one pair each upon mesothorax and first and eighth abdominal segments. The metathoracic pair in Terebrantia is small, invisible except in carefully prepared specimens, and in some cases I have been unable to find any trace of it. In the larva the stigmata are distributed in the same way except that they are present on the second abdominal segment and not on the first.

Young resemble adults in general form, structure of mouth parts, and in food habits. There is, however, a distinct pupal stage during

which the insect moves very little or not at all, and takes no food. The wings develop entirely during this stage and are outside the body skin. The metamorphosis approaches closely to a complete one, but on account of the similarity of larval and adult forms and mouth parts it must still be considered as incomplete. Reproduction is oviparous and frequently parthenogenetic.

METHOD OF MEASUREMENTS.

A few of the descriptions of Thysanoptera previously published have been found to be too brief and general for the recognition of the species. Another difficulty which has been noted in some descriptions is the giving of comparative dimensions relative to other species. This may be useful to the collector if he happens to have or know all the species referred to; otherwise he is at an utter loss to know what is meant. Having experienced these difficulties at various times, the writer came to the conclusion that each description should be absolutely complete in itself and independent of all others, and that therefore a system of measurements based entirely upon the species under consideration would frequently prove of service in the determination and separation of these insects. The eye can not be relied upon for exactness in this matter, as has been frequently found in the course of this work, and therefore all measurements given in the following descriptions have been made in the same way, by means of an eyepiece micrometer, as follows: A stage micrometer of reliable make was first proven to be accurate by comparison with a steel millimeter scale, then with each combination of lenses used the number of spaces on the image of the stage micrometer covered by the scale of the eyepiece micrometer were determined, two points being selected where the divisions coincided. Then the number of spaces covered on the stage micrometer was divided by the number of spaces of the eyepiece micrometer covering them, and the quotient was, evidently, the fraction of a micromillimeter upon the stage shown by one division of the eyepiece micrometer. This quotient may be called the factor of the eyepiece micrometer for that combination of lenses and will hold unchanged for any object measured with that magnification, but will of course vary for every other magnification. Illustration: Using a 1-inch objective and a 1-inch eyepiece (Bausch and Lomb) with the tube closed, I find that the fifty divisions of the eyepiece micrometer cover, say, exactly 1 millimeter of the stage micrometer. Dividing then 1 millimeter by 50, I have two one-hundredths millimeter, which is the factor for that combination of lenses. Now, placing the object to be measured upon the stage, we find, e. g., that forty-five spaces of our eyepiece micrometer just cover the object to be measured. Multiplying by the determined factor, we have two one-hundredths millimeter times forty-five, which equals ninety one-hundredths millimeter the length of the object measured. This method has been used in

the determination of length and breadth of the species herein described.

When comparative lengths only are desired, as e. g. in the comparative lengths of segments of antennæ, relative length and breadth of the head, etc., there is no need to determine the actual measurement. It is sufficient to compare directly the number of spaces read upon the eyepiece micrometer, and this is the method used in such cases. In the case of the comparative lengths of segments of the antennæ, all measurements have been made with a $\frac{1}{4}$ -inch objective and a 1-inch eyepiece. The measurements given show, therefore, not only a comparison between the segments of one antenna, but also between the segments of all antennæ so measured. The number of the segment has been given above the line, and directly below it the number of spaces of the eyepiece micrometer covering that segment. Illustration:

Number of segment,	1	2	3	4	5	etc.
Spaces of micrometer,	$\frac{1}{5}$	$\frac{2}{10}$	$\frac{3}{14}$	$\frac{4}{12}$	$\frac{5}{9}$	etc.

It has been found that there are slight individual variations in the lengths of corresponding segments in different specimens of the same species, and even in the two antennæ of the same specimen, still there is in general a quite close agreement in this respect and the proportions hold very well. The antennæ were selected for such critical study, because there is an evident variation in the proportional lengths of segments in each species, and because the antennæ are the most surely available for a careful, accurate study of any organs of the insect. Then, again, proportional measurements do not vary nearly as much as do the absolute measurements of different sized individuals.

All statements made as to lengths, both actual and comparative, in the descriptions herein given are based upon actual measurements made in one or the other of these ways, an average being taken of the total number of specimens used in the description.

In describing colors it has been my intention to follow a few definite rules, which are given herewith: First, to name colors in plain, well-known terms when possible; second, when the color being described appears to result from a mixture, in equal proportions, of two more elementary colors, they have been given together in the same form and connected by a hyphen (gray-brown); third, when a predominant ground color is modified by more or less mixture with another color, the name of the ground color has been given last with the modifying color preceding it (grayish brown). Depth of coloring is indicated by such words as light, dark, etc.

INDIVIDUAL VARIATIONS.

Individual variation must always be considered in specific determinations and due allowance made therefor. The most common variation will naturally be found in the line of color. It is probable that to a slight extent the age of the individual may influence the depth of the

coloring, because a short time is required, in several species which have been observed at least, after the emergence of the adult from the pupal stage before the full depth of coloring is acquired. There is, however, a common variation in color, apparently not due to difference in age, producing in some of the most variable species color varieties. These may be either lighter or darker than the color of the typical form, but, so far as our observations have gone, complete intergrades are to be found.

A variation from the usual number of segments in the antennæ is quite frequently met with, but this is always in the line of a reduction in number due usually to a fusion of the last two or more segments.

The length and breadth of the abdomen is, perhaps, the most variable character, as in most species the segments are slightly telescoped naturally, and being connected with each other by a flexible membrane are capable of great distension. This may be caused naturally by the simultaneous development of a number of eggs in the ovaries of a female. When specimens are mounted in balsam, glycerin, or any such medium for study, there is danger of compressing the body of the insect if care be not taken to have present plenty of the mounting medium, and the usual result of this compression is the distension of the abdomen.

Measurements of a series of specimens show that a variation, often amounting to one-sixth, sometimes as high as one-fourth, frequently occurs between the extremes in the size of individuals in the same species.

SYNOPSIS OF SUBORDERS AND FAMILIES.

- | | | | |
|---|---|--|-------------------------|
| 1 | { | Female with a saw-like ovipositor. Terminal segment of abdomen of female conical; that of males rarely like females, but usually bluntly rounded. Fore wings with at least one longitudinal vein reaching from base to tip of wing. | TEREBRANTIA (p. 124). 2 |
| | | Female without an ovipositor. Terminal segment tubular in both sexes. Both pairs of wings similar in structure with only one median longitudinal vein, and this only partially developed, never reaching to tip of wing. .TUBULIFERA (p. 187). Includes single family Phleothripidæ. | |
| 2 | { | Antennæ with nine segments. Wings broad and rounded at the tips; fore wings with cross veins. Ovipositor of female up-curvedEOLOTHRIPIDÆ (p. 126). | |
| | | Antennæ with six to eight segments. Wings usually narrow and pointed at tips, without cross veins. Ovipositor of female down-curved. .THRIPIDÆ (p. 132). | |

CHARACTERS OF TEREBRANTIA.

Antennæ have from six to nine segments, the terminal segments being usually much smaller than the preceding. Ocelli absent in the entirely wingless forms (*Aptinothrips rufus*) as in all wingless Thysanoptera, and sometimes in the wingless males of species in which the females are winged, they are present in all long winged forms. Maxillary palpi usually three, sometimes two segmented, and labial palpi usually two, sometimes four segmented.

Prothorax rarely longer than broad, but usually transverse, frequently twice as wide as long, ordinarily rectangular in general outline and scarcely wider at the hind edge than at the fore edge, except in the genus *Chirothrips*, in which it is strongly broadened behind, where it is about twice as wide as at front edge. The fore wings are broader, stronger, and much more specialized than the hind wings, shaded darker, if shaded at all. As a rule they have more veins, there being usually two, sometimes apparently only one, fully developed longitudinal veins besides frequently a strongly developed vein following the border of the wing and known as the ring vein; cross veins are present in some cases. The veins are usually set with more or less numerous and conspicuous spines which vary in size, the smallest being minute and indistinct, the largest extremely stout and conspicuous, exceeding in length the breadth of the membrane of the wing. The membrane itself is thickly set with numerous microscopic spines. A fringe is always present upon the hind margin, consisting on the hind wing of one, on the fore wing of two rows of long usually wavy hairs. On the fore wing these rows appear to be placed at different angles to the edge, so that instead of the hairs being parallel when the wing is in action, they cross each other at a slight angle, thereby forming a mesh-work which must add materially to the strength and resistant power of the wing. Spines such as are found on the other veins are wanting upon the hind margin. The fringe upon the front is always shorter than that upon the hind edge and is composed of a single row of stouter, more bristle-like hairs. The development of the fore fringe appears to be in inverse proportion to that of the spines borne upon the costal edge, and when these last are very stout the fringe is vestigial, though sometimes both fringe and spines are wanting on the costa. In many cases the shading of the fore wings takes the form of dark cross bands alternating with light or almost white bands or areas. The hind wings are more slender and more delicate than the fore wings and have but one median longitudinal vein, usually fully developed, and no ring or cross veins. The median vein is without spines such as are borne upon the veins of the fore wing. The hind fringe is single instead of double and the fore edge always bears a more or less well-developed fringe. Shading of the hind wings is very slight and a distinct banding of them is not known. When at rest the wings are laid straight back upon the abdomen, the fore wing of each side completely covering the hind wing and each pair lying parallel to but not upon the other. The hind fringes are very flexible or jointed at their attachment to the wings and when at rest point backward between them. The wings are very frequently reduced to small, rounded or oval pads which are usually invisible even when present. Rarely they are entirely absent, but when this is the case the structure of the thorax indicates the fact. The fore legs are often more thickened

than the others—in the genus *Chirothrips* they are extremely thickened. The hind legs are usually longest and sometimes exceed the abdomen in length.

The abdomen is constricted somewhat at its junction with the thorax and is always ten segmented. The terminal segments are usually shaped differently in the two sexes; in the females the last three segments form a cone the apex of which is quite pointed, and rarely the last segment is rather tubular instead of conical. The abdomen of the male is usually more slender and lighter than that of the female, and as a rule its end is much more blunt, though occasionally shaped much like that of the other sex. The ninth segment is comparatively large and contains the genital apparatus, and frequently the tenth segment is also much retracted within it. In the females the sexual opening is between the eighth and ninth abdominal segments, but in the males it is between the ninth and tenth.

The female has a four-valved, saw-like ovipositor fitted to the underside of the eighth and ninth segments and reaching to about the tip of the abdomen, sometimes a little beyond. When at rest this apparatus lies partially concealed in a sheath on the underside of the last three segments; when in action it can be let down so as to work at almost any angle less than 90 degrees. The copulatory apparatus of the male is almost or entirely withdrawn into the body, but it is freely protrusile.

The males are often quicker motioned and more active than the females. Most of the members of this suborder move rapidly, though some are quite sluggish: they run rapidly and take flight readily. Some species, provided with well-developed wings, seem loath to use them, and many possess a considerable power of leaping.

Family EOLOTHRIPIDÆ.

The antennæ are nine segmented. Ocelli are present in both sexes. The maxillary palpi are three segmented, and the labial palpi two or four segmented. The wings are large, broad, and rounded at the outer ends. In addition to a heavy ring vein, each fore wing has two longitudinal veins extending from its base to tip, where they unite with the ring vein on each side of the tip, while the hind wings have only a vestige of a median longitudinal vein. Four or five cross veins are present in each fore wing. The fore wings are without a fringe upon the front edge, though some more or less stout hairs are there present in some species. Both sexes bear a peculiar hook-like appendage on the underside of the second segment of each fore tarsus. (See Plate I, fig. 9.) The ovipositor of the female is bent upward so that its convex side is ventral. The males have the first abdominal segment much longer than the second. The members of this family run rapidly, having very long legs, but they do not appear to have the power of springing.

The genus *Eolothrips* is the only one of the three genera of this family found in the United States.

Genus *ÆOLOTHRIPS* Haliday.

Head about as broad as long. Ocelli present in both sexes. Antennæ nine segmented, the last three or four segments being very much shorter than the preceding and closely joined together: third segment much longer than any other. Maxillary palpi three segmented, geniculate. Prothorax about as long or a little longer than the head, without large bristles. Legs very long and slender: fore femora somewhat thickened in both sexes; hind femora broadened; fore tibiæ unarmed; second fore tarsal segment, in both sexes, with hook-like appendage. Wings usually present in both sexes: fore wing somewhat narrowed before the middle: fore part of the ring vein furnished with very short hairs, which hardly overreach the edge of the wing. Fore wings white, with two broad, dark cross bands. First abdominal segment in the males much longer than the second, and the ninth segment is drawn out at the hind angles into short clasping organs or hooks.

The two species which I place here can be distinguished by the presence of a white band around abdominal segments two and three in the female of *Æ. bicolor*, which band is wanting in the female of *Æ. fasciatus*. The last four segments of the antenna taken together are much longer in *Æ. bicolor* than the fifth, while in *Æ. fasciatus* the last four segments together are approximately as long as is the fifth alone.

ÆOLOTHRIPS FASCIATUS (Linnaeus).

Plate I, figs. 1-3.

- Thrips fasciata* LINNÆUS, Syst. Naturæ, 10th ed., 1758, p. 457.
Thrips fasciata LINNÆUS, Fauna Svecica, 1761, p. 266.—DEOFFROY, Histoire abrégée des Insectes, 1764, p. 385.
Thrips fasciata LINNÆUS, Syst. Naturæ, 12th ed., Holmiæ, and 13th ed., Vindobonæ, I, Pt. 2, 1767, p. 743.
Thrips fasciata FABRICIUS, Systema Entomologia, 1775, p. 745.
Thrips fasciata SCHRANK, Enumeratio Insectorum Austriæ indig., 1781, p. 297.
Thrips fasciata FABRICIUS, Species Insectorum, II, 1781, p. 397.
Thrips fasciata FABRICIUS, Mantissa Insectorum, II, 1781, p. 320.
Thrips fasciata GIMELIN, Linn. Syst. Nat., 13th ed., Pt. 4, 1788, p. 2223.
Thrips fasciata BERKENHOUT, Synop. Nat. Hist. Gt. Br. and Ire., 1789, p. 123.
Thrips fasciata FABRICIUS, Entom. Systematica, IV, 1794, p. 229.
Thrips fasciata STREW, Elem. of Nat. Hist., II, 1802, p. 114.
Thrips fasciata FABRICIUS, Systema Rhynqotorum, 1803, p. 314.
Thrips fasciata TURTON, A General Syst. of Nat. (Transl. from Gmelin's Syst. Nat., 13th ed.), II, 1806, p. 717.
Æolothrips (Coleothrips) fasciata HALIDAY, Ent. Mag., III, 1836, p. 451.
Æolothrips fasciata BURMEISTER, Handbuch d. Entom., II, 1838, p. 417.
Æolothrips fasciata AMYOT and SERVILLE, Hist. nat. d. Ins. Hemipt., 1843, p. 646.

- Eolothrips* (*Coleothrips*) *fasciata* HALIDAY, Walker, Homopt. Ins. of Brit. Mus., Pt. 4, 1852, p. 1117, pl. VII, figs. 31-42.
- Eolothrips fasciata* HEEGER, Sitzungsab. d. Acad. d. Wiss. Wien, VIII, 1852, pp. 135-136, pl. XXI.
- Coleothrips trifasciata* FITCH, Count. Gent., VI, Dec. 1855, p. 385.
- Coleothrips trifasciata* FITCH, Second Rept. Nox. Ins. N. Y. 1857, p. 308 (or 540).
- Thrips fasciata* DE MAN, Tijdschr. v. Entomol., 1871, p. 147.
- Eolothrips* (*Coleothrips*) *fasciata*, RETTER, Diagnoser öfver nya Thysanop. från Finl., 1879, p. 7, or Öfv. Fin. Soc., XXI, 1879, p. 214.
- Coleothrips fasciata* PERGANDE, Entomologist, April, 1882, p. 95.
- Coleothrips trifasciata* WEBSTER, Rept. Dept. Agr., 1886, p. 577.
- Coleothrips trifasciata* THAXTER, Rept. Conn. Agr. Exp. Sta. for 1889, (1889), p. 180.
- Coleothrips 3-fasciata* RILEY-HOWARD, Ins. Life, III, 1891, p. 301.
- Coleothrips trifasciata* TOWNSEND, Canad. Ent., XXIV, 1892, p. 197.
- Coleothrips trifasciata* GILLETTE, Bull. 24, Col. Agr. Exp. Sta., 1893, p. 15.
- Coleothrips trifasciata* DAVIS, Bull. 102, Mich. Agr. Exp. Sta., 1893, p. 39, fig. 10.
- Coleothrips trifasciata* COCKERELL, Bull. 15, N. Mex. Agr. Exp. Sta., 1895, p. 71.
- Eolothrips fasciata* UZEL, Monographie d. Ord. Thysanop., 1895, p. 72, pl. I, fig. 4; pl. V, figs. 46-48.
- Coleothrips trifasciata* DAVIS, Special Bull. No. 2, Mich. Agr. Exp. Sta., 1896, p. 13, fig. 4.
- Eolothrips fasciata* TÜMPER, Die Geradflügler Mitteleuropas, 1901, p. 286, pl. XXIII.

Female.—Length, 1.63 mm. (1.36 to 1.76 mm.); width of mesothorax, 0.30 mm. (0.27 to 0.34 mm.). General collar yellowish brown to dark brown. Head slightly wider than long, rectangular in outline, retracted slightly within prothorax; cheeks arched but slightly behind eyes; front nearly straight; surface of head but faintly striated and bearing numerous minute spines. Eyes large, black, elongated downward; borders of eyes light; ocelli small, well separated, orange-yellow with maroon crescents. Mouth cone sharply pointed; maxillary palpi geniculate, three segmented; labial palpi four segmented; chitinous thickening extending from left eye connected with that at juncture of mouth cone with frons; just a trace of such thickening extends down from right eye; the two spines standing at base of frons close to transverse thickening are less than twice as long as sub-antennal pair of spines. Antennæ nine segmented, nearly three times as long as head and very slender, approximate at base; relative lengths of segments:

1	2	3	4	5	6	7	8	9
5.5	15	31	26	17	17			

Segment one thickest, cylindrical; two is a little thicker than three; but five segments are closely joined and from base of six they taper gradually to the tip. Antennæ brown except tip of two and all but extreme tip of three nearly white; all segments quite thickly and uniformly clothed with short spines; those around tip of two being much the shortest; no sense cones present, but both three and four

have an elongated, narrow, membranous sense area on under side of outer half: five bears a small, rounded spot of similar texture near tip below.

Prothorax somewhat wider than long, and a little wider than head, nearly rectangular in shape: sides but slightly arched, without conspicuous spines but with numerous minute ones. Mesothorax smoothly rounded at front angles. Metathorax slightly narrower at front end than mesothorax and tapering somewhat posteriorly. Wings always present, about one-seventh as broad as long, rounded at tips: fore wing heavily veined having a ring vein and two longitudinal veins which extend from the base and join the ring vein just before the tip of the wing: fore vein united to costa by two cross veins at one-third and two-thirds its length: longitudinal veins united by one cross vein just before the middle and the hind vein is joined to the hind ring vein opposite the outer front cross vein: hind wing veinless. No fringe upon costa of either wing, but costa and longitudinal veins set with a number of short, dark spines: hind fringe hairs short and straight, double row on fore wing. Fore wings with three white bands (at base, middle, and tip) and wider dark brown cross bands between these: hind wings with similar areas, but the two darker bands are so pale gray that they are hardly noticable. Legs gray-brown, dark brown in dark specimens, very long and slender: fore femora slightly thickened and tarsi armed with a peculiar, hook-like structure opposed to a stout tooth something like a forefinger and thumb (Plate I, fig. 9); first segment of all tarsi very short: all legs thickly set with short spines: all tibiae armed with very stout spines at tips.

Abdomen about two-thirds the length of the whole body, small at base, enlarging to the middle: segments frequently overlapping considerably in the last half: last three segments long and tapering to tip: ovipositor very long and up-curved: spines upon last two segments long, dark, and conspicuous. Entire body yellowish brown to dark brown: connective tissue red.

Redescribed from seven specimens. No males found.

Food plants.—Alfalfa, buckwheat, celery, clover, Compositæ, oats, onion, tansy, wheat, various grasses and weeds.

Habitat.—England (Haliday), Vienna (Heeger), Finland (Reuter), Germany (Jordan, Bohls, near Berlin. Uzel), United States: Connecticut, Indiana, Iowa, Massachusetts, Michigan, New Mexico, New York, Ohio,

Larva.—"Larva yellow, the abdomen behind deeper orange, a whorl of hairs on each segment, more conspicuous on the last two; prothorax elongate; antennæ shorter than in the perfect insect, the number of joints similar; mouth nearly perpendicular, not inflected under the breast; joints of maxillary palpi not very unequal."—Haliday.

Life history unknown. Fitch observed that it was abundant on

wheat early in the season and afterward passed to later-flowering plants, such as tansy (*Tanacetum vulgare*). Webster found it common in all stages on buckwheat in Ohio.

Thaxter believed that this species caused the rust of oats in Connecticut. Davis has reported it as the most common species on the heads of clover in Michigan, and found it both in and out doors on many plants.

ÆOLOTHRIPS BICOLOR, new species.

Plate I, figs. 4-9.

Female.—Length, 1.9 mm.; width of mesothorax, 0.29 mm.; width of abdomen, 0.38 mm. General color light yellowish brown to dark brown.

Head as wide as long, also as long and as wide as prothorax; cheeks slightly arched behind eyes; anterior margin slightly arcuate; occiput transversely striated, quite thickly clothed with minute spines. Eyes large, black, elongated downward, coarsely granulated, each facet distinct, slightly pilose; ocelli separated, bright reddish yellow, margined inwardly with maroon crescents. Mouth cone sharp; maxillary palpi three segmented, geniculate, third segment very small; labial palpi four segmented, first segment very short. Chitinous thickening around left eye connected with that uniting mouth cone to frons; only a short vestige of such thickening below right eye; two long, slender spines are borne upon frons in front of the middle of the transverse thickening and one equally long spine upon middle of labrum; these spines are many times as long as any others upon the head. Antennæ as long as head, pro and mesothorax together, slender, filamentous, approximate at base; relative lengths of segments as follows:

1	2	3	4	5	6	7	8	9
8.1	13.2	37.1	2.9	19.6	12.6	7.3	3.8	2.9

Segment one thickest, as long as wide; three to six slightly narrower than two; seven to nine tapering; the last very minute and conical. All segments, except three, of uniform brown color; three is very pale yellowish white, except brown band around apex; two is brown at base fading to light yellowish at apex. Segments three to nine quite evenly clothed with fine hairs of uniform size; three and four bear each a narrow, light-colored, membranous strip on outer part of underside, indistinct upon three on account of its light color; a small elliptical spot of similar structure near tip of five beneath.

Prothorax nearly square, slightly constricted in middle, with numerous minute spines, but none conspicuous. Mesonotum transversely striated; fore angles of mesothorax broadly rounded. Metanotum reticulate; metathorax tapering posteriorly. Wings broad, rounded at tips; fore wing with two longitudinal veins which bend outward

just before the tip and unite with the ring vein: fore longitudinal vein united to front part of ring vein by two cross veins at about the first and second thirds of its length and to the hind vein by one cross vein just before the middle of the wing; hind vein united to hind part of ring vein by one cross vein at about three-fifths the length of the wing. Fore part of ring vein and both longitudinal veins set with numerous short, dark spines; both pairs of wings thickly covered with microscopic spines; no fringe upon front edge of fore wings, but a very light one upon hind wings; posterior fringe on fore wings double, on hind wings single; hind wings veinless. Wings clear white; fore pair conspicuously marked with two broad, brown bands so that there are narrow white bands across the base, middle, and tip of the wing; hind wings almost clear white. Legs concolorous with body, very long and slender; fore femora slightly thickened, but less than half as wide as long; second segment of fore tarsus fitted with a peculiar hook-like structure recurved toward base of segment and at tip opposed to a stout tooth. All legs quite thickly set with small spines; hind legs much the longest, nearly as long as wings; each tibia armed at apex with two or more stout spines.

Abdomen small at base, enlarging gradually to its sixth segment, where it is about one-fifth as wide as the body is long; eight, nine, and ten tapering uniformly and quite abruptly; no marked difference in length of segments. Posterior part of segment one and segments two and three white or yellowish in color; remainder of abdomen yellowish brown to dark brown. No spines apparent upon the abdomen, except on last three segments; nine bears a circlet of eight long slender bristles near its posterior edge; ten bears six similar bristles. Ovipositor very powerful, up-curved, and extending a little beyond the tip of abdomen.

Described from nine females.

otype.—Cat. No. 6323, U.S.N.M.

Male.—Length but little more than 1 mm.; width of mesothorax slightly less than one-fourth body length. General color tawny yellowish with brown extremities to appendages, not nearly as dark as female.

Head subequal in length and breadth and slightly smaller than prothorax; spines in front of transverse thickening at base of mouth cone not conspicuously long. Antennæ three and one-half times as long as head, almost equal to length of abdomen; relative lengths of segments as follows:

1	2	3	4	5	6	7	8	9
$\frac{1}{7.7}$	$\frac{2}{11}$	$\frac{3}{34.3}$	$\frac{4}{28}$	$\frac{5}{22.3}$	$\frac{6}{17}$	$\frac{7}{11}$	$\frac{8}{2}$	$\frac{9}{2}$

Outer two-thirds of antenna dark brown; first three segments light gray-brown, two and basal half of three being lightest; antennæ very

hairy. Hind legs very slender, longer than abdomen; all femora and fore tibiae brownish yellow shaded darkest above; middle and hind tibiae and tarsi gray-brown to dark brown.

Abdomen very small, but slightly longer than antennae and not as broad as mesothorax, narrowed somewhat at attachment to thorax, increasing gradually in breadth up to ninth segment; tenth segment very abruptly smaller and conical. Segment one very long and marked by two brown, longitudinal carinae dividing it into thirds dorsally. Ninth segment also peculiar, being very long and as broad as any in the abdomen; hind angles produced into a pair of claspers, also bearing a pair of stout spines; tenth segment small and set with quite long, stout spines. Second, third, and fourth segments nearly white, sometimes irregularly suffused with yellow; rest of abdomen tawny yellow.

Described from three males.

Cotype.—Cat. No. 6323, U.S.N.M.

These males differ much more than is usual from the description of the female but it seems that they are more closely allied structurally to *A. bicolor* than to *A. fasciatus*, and so I place them with the former species.

Food plants.—*Brunella vulgaris*, *Panicum sanguinale*, bindweed, and various grasses in mowings.

Habitat.—Amherst, Massachusetts.

Family THRIPIDÆ.

The members of this family have from six to eight segmented antennae (apparently nine segmented in *Anaphothrips striatus* and *Pseudothrips inequalis*); the segments beyond the sixth are usually short and form what is called the style. Maxillary palpi are usually three, sometimes two segmented; labial palpi never composed of more than two segments. The wings of Thripidae are usually slender, gradually tapering more or less and pointed at the tips. The fore wings, as a rule, present two parallel longitudinal veins, the front one running from the base to near the tip of the wing; the hind vein appears usually as a branch from the fore vein at about one-third the length of the wing. Sometimes, however, all connection between these veins is wanting. Cross veins are rarely visible, though traces of them can sometimes be seen. The ring vein is not usually very heavy or prominent. A fringe is generally present upon the front margin of the fore wing, but may be vestigial. More or less stout spines are found along the veins and costa of the fore wing. The hind wing has one median, longitudinal vein without spines and no cross or ring veins, but the costa bears a fringe. The ovipositor of the female is bent downward, i. e., concave side ventral.

SYNOPSIS OF THIRIPIDE

1	{ Antennæ with eight segments	2
	{ Antennæ with seven segments	11
2	{ Body with markedly reticulated surface	<i>Heliothrips</i> (p. 168)
	{ Body without reticulate surface	3
3	{ Abdomen clothed with fine hairs and having a silky luster. <i>Sericothrips</i> (p. 141)	
	{ Body without clothing of fine hairs	4
4	{ Last two segments of the antenna longer than the sixth. <i>Rhopidothrips</i> (p. 158)	
	{ Last two segments shorter than sixth	5
5	{ Terminal segment of abdomen with a pair of extremely stout, short spines near the tip above	<i>Limothrips</i> (p. 138)
	{ Terminal segment without unusually stout spines	6
6	{ Antennæ with second segment drawn out into an acute process on outer angle	<i>Chirothrips</i> (p. 133)
	{ Second segment of antennæ normally symmetrical	7
7	{ Ocelli and wings wanting	<i>Aptothrips</i> (p. 166)
	{ Ocelli and wings present	8
8	{ With spines at hind angles of prothorax	9
	{ Without spines at hind angles of prothorax	<i>Anaphothrips</i> (p. 160)
9	{ With two long spines at each hind angle of prothorax	10
	{ With one long spine at each hind angle of prothorax	<i>Pseudothrips</i> (p. 146)
10	{ Without a long spine at middle of each side of prothorax	<i>Euthrips</i> (p. 147)
	{ With a long spine at middle of each side of prothorax	<i>Scotothrips</i> (p. 157)
11	{ Fore wings broad and without front fringe	<i>Parthenothrips</i> (p. 175)
	{ Fore wings slender, spines on outer half fewer than on basal ...	<i>Thrips</i> (p. 178)

Genus CHIROTHRIPS Haliday.

Body thickened. Head very small and in front of the eyes drawn out into a three-cornered process upon which the antennæ are situated. Ocelli present in the females and located very far back; wanting in the males. Antennæ eight segmented, the second segment ending in a blunt prominence at the outer angle. Maxillary palpi three segmented. Prothorax nearly twice as long as the head, and trapezoidal in form, being about twice as broad at the hind edge as at the fore edge. Two prominent spines present at the hind angles or wanting in some species. Legs short; the fore pair extremely thickened, so that the tibiæ are short and broad and the tarsi small. Wings long and very slender; fore wing with two veins upon which there stand a few small spines; front fringe well developed. Males wingless.

SYNOPSIS OF SPECIES.

1	{ With two moderately long spines at each hind angle	<i>manicatus</i> (p. 134)
	{ Without long spines at the hind angles	2
2	{ Abdomen light yellow	<i>obesus</i> (p. 137)
	{ Abdomen light brown	<i>crassus</i> (p. 136)

CHIROTHRIPS MANICATUS Haliday.

Plate II, figs. 14-16.

- Thrips* (*Chirothrips*) *manicatu* HALIDAY, Entom. Mag., III, 1836, p. 444.
Thrips manicata BURMEISTER, Handb. d. Entomologie, II, 1838, p. 413.
Thrips longipennis BURMEISTER, Handb. d. Entomologie, II, 1838, p. 413.
Chirothrips manicata AMYOT and SERVILE, Ins. Hemipteres, 1843, p. 642.
Chirothrips longipennis AMYOT and SERVILE, Ins. Hemipteres, 1843, p. 642.
Thrips (*Chirothrips*) *manicata* HALIDAY, Walker, Homopt. Ins. Brit. Mus., 1852, p. 1106, pl. VI, fig. 12.
Thrips (*Chirothrips*) *manicata* REUTER, Diagn. öfv. nya Thysanopt. f. Finland, (1878-79), pp. 5, 6.
Chirothrips antennatus OSBORN, Canad. Ent., XV, 1883, p. 154.
Chirothrips antennatus LINDEMAN, Bull. d. Soc. Imp. d. Nat. d. Moscow, LXII, 1886, No. 4, pp. 322-323, fig. 12.
Chirothrips manicatu JABLONOWSKI, Termes. Fuzetek, XVII, 1894, p. 47.
Chirothrips manicata UZEL, Mon. d. Ord. Thysanoptera, 1895, p. 80, pl. I, fig. 2; pl. VI, fig. 49.
Chirothrips manicata TCMPEL, Die Geradfugler Mitteleuropas, 1901, p. 287.

Female.—Length 1 mm. (0.84 to 1.18 mm.); width of mesothorax 0.27 mm. (0.24 to 0.32 mm.). General color quite uniform dark yellowish brown.

Head somewhat shorter than wide, almost conoid in shape, frequently hidden up to the eyes in the prothorax; cheeks only about one-third the length of the eye; head prolonged into a triangular process in front of the eyes; a row of four small spines across the head between the front edges of the eyes and one small spine on each side of the anterior ocellus. Eyes large, black, rather coarsely faceted; ocelli subapproximate, almost white or pale yellowish with heavy maroon crescentic inner margins, placed in a low triangle far back between hind half of eyes. Mouth cone short, broad and blunt; maxillary palpi three segmented. Antennæ less than twice the length of head; segments thick and more or less rounded; relative-lengths of segments as follows:

1	2	3	4	5	6	7	8
5.8	5.9	6.4	7.5	6	8	2.5	2.5

. Basal segments very broad and almost contiguous; two drawn out into a short, blunt angle on outer side; three and four bear each one very stout, blunt sense cone on outer angle. All segments brown; tips of two and three frequently yellowish.

Prothorax large, trapezoidal, a little less than twice as long as head, as wide as head in front and twice as wide behind; sides nearly straight. Surface dotted with numerous very small spines and marked with numerous, arched wrinkles, giving it a scaly appearance; numerous small spines stand at hind edge, and two spines at each hind angle are much longer than the others. Mesothorax a little broader than

the prothorax, widest behind, sides curving forward; metathorax abruptly somewhat narrower, and its sides curve inward to base of abdomen. Wings nearly always fully developed in females, about four-fifths as long as body and in middle about one-seventeenth as broad as long, sharply pointed at ends, heavily fringed on both edges. Hind longitudinal vein branches from the fore at about one-fourth the length of the wing; fore vein bears six or seven spines before the branching off of the hind vein; beyond this the fore vein bears usually two and the hind vein four spines; costa bears numerous short spines. Fore wings gray-brown; hind wings gray. Legs short and powerful; fore femora extremely short, nearly as broad at base as long, wrinkled on surface and at tip outside with chitin turned up into a sort of tooth; fore tibiae also extremely short and thick; each tibia bearing a row of spines of gradually increasing length and stoutness on inner side toward tip; these are most strongly developed on hind legs. Legs dark brown except tarsi more or less gray or yellowish.

Abdomen broader than mesothorax, hardly twice as long as broad (segments usually overlapping considerably and giving a dark and light brown banded appearance); spines around last two segments moderately long and stout, dark brown and conspicuous; ovipositor of good length. Color of abdomen uniform dark brown; receptaculum seminis inconspicuous or invisible.

Redescribed from ten females.

Male.—Length 0.83 mm. (0.66 to 0.96 mm.); width of mesothorax 0.22 mm. (0.20 to 0.24 mm.).

Ocelli wanting; spines on head as in female. Relative lengths of antennal segments as follows:

$\frac{1}{5.2}$	$\frac{2}{5.2}$	$\frac{3}{5.9}$	$\frac{4}{6.5}$	$\frac{5}{4.4}$	$\frac{6}{5.6}$	$\frac{7}{1.8}$	$\frac{8}{1.8}$
-----------------	-----------------	-----------------	-----------------	-----------------	-----------------	-----------------	-----------------

Segments two and three pale yellowish. Wings entirely wanting. Abdomen more narrow than in female and bluntly rounded at the end. Ninth segment very large, conoid; tenth segment retracted therein; ninth with a short stout spine on each side of the hind edge above; genital apparatus protruding beyond the tip of tenth segment; a rounded light depression in middle of ventral plates on segments three to six.

Described from five males.

Food plants.—Flowers of various grasses and cereals, clover, wild carrot.

Habitat.—England (Haliday), Germany (Burmeister, Jordan, Bohls), Finland (Reuter), Russia (Lindeman), Bohemia (Uzel), United States: Manchester, Iowa; Amherst, Massachusetts.

Life history unknown except that they hibernate in dried flower stems and in turf.

I have compared my specimens with those of Osborn's *C. antennatus* and they are identical.

CHIROTHRIPS CRASSUS, new species.

Plate II, figs. 17-20.

Female.—Length 0.78 mm.; width of mesothorax 0.26 mm. General color of head and thorax brown; abdomen gray-brown or yellowish brown.

Head very small, slightly wider than long, narrowed in front between the eyes and elongated anteriorly; distance between eyes equal to one-half the width of head; frons between antennae bluntly acuminate. Eyes reddish orange by reflected light; ocelli placed in a low triangle far back between hind edge of eyes; each ocellus pale, margined inwardly with a dark-red crescent. Mouth cone very short and broadly rounded; maxillary palpi short, three segmented. Antennae approximate at base; relative lengths of segments as follows:

$\frac{1}{4.5}$	$\frac{2}{6}$	$\frac{3}{7}$	$\frac{4}{6.5}$	$\frac{5}{6}$	$\frac{6}{8.3}$	$\frac{7}{2.8}$	$\frac{8}{3}$
-----------------	---------------	---------------	-----------------	---------------	-----------------	-----------------	---------------

Basal segments large, longitudinally compressed, nearly twice as wide as long; segment two drawn out at outer angle into an acute process; three with slender peduncle, subpyriform, bearing one prominent sense cone on outside, as does also four; four and five rounded; four nearly as thick as long; five somewhat narrower; six elongated; seven and eight moderately slender. One and two pale straw yellow; three to six shading gradually to a medium brown; seven and eight also medium brown.

Prothorax one and one-half times as long as head, one and three-fourths times as wide as long, twice as wide at posterior edge as at anterior; sides nearly straight, indented above fore coxae, with prominent spines at posterior angles. Mesothorax one and one-fourth times as wide as prothorax, quite a deep constriction between mesothorax and metathorax; pterothorax with more or less rusty tinge. Wings long, saber-formed, slightly overreaching the tip of the abdomen; fore wings shaded with gray, hind wings nearly clear. Fore longitudinal vein extends through the wing; hind vein arises from fore vein at one-third its length; both veins disappear before reaching the tip of the wing. Fore vein bears two spines on distal half; hind vein bears five spines. Legs short; fore pair strongly thickened; all femora grayish or yellowish brown; fore tibiae and all tarsi pale yellowish; middle and hind tibiae brownish at bases and above, fading to pale gray or yellow beneath and at extremities.

Abdomen elongate-ovate in outline, bluntly pointed at tip, one and four-fifths times as long as broad; spines upon last two segments short, weak, and inconspicuous; ovipositor short and weak. Color rusty-gray brownish upon sides, and pale yellowish upon last two segments.

Described from two females.

Cotype.—Cat. No. 6324, U.S.N.M.

Male.—Length 0.66 mm. (0.58 to 0.78 mm.); width of mesothorax 0.23 mm. (0.19 to 0.25 mm.). General color of head and prothorax grayish or yellowish brown; pterothorax abruptly pale yellowish, shading through gray to chestnut brown upon last two abdominal segments.

Head as wide as long, without ocelli; relative lengths of antennal segments as follows:

$\frac{1}{4.4}$	$\frac{2}{5.9}$	$\frac{3}{5.9}$	$\frac{4}{5.9}$	$\frac{5}{5.2}$	$\frac{6}{7.9}$	$\frac{7}{2.2}$	$\frac{8}{2.6}$
-----------------	-----------------	-----------------	-----------------	-----------------	-----------------	-----------------	-----------------

Prothorax one and one-third times as long as head, and one and one-half times as wide as long; mesothorax one and one-sixth times as wide as prothorax; wings wanting; terminal two segments conoid; spines thereupon slightly more prominent than in female.

Described from seven males.

Cotype.—Cat. No. 6324, U.S. N.M.

Food plant.—*Panicum capillare*.

Habitat.—Amherst, Massachusetts.

Life history unknown.

CHIROTHRIPS OBESUS, new species.

Plate II, figs. 21, 22.

Female.—Length 0.78 mm.; width of mesothorax 0.29 mm.; width of abdomen 0.275 mm. General color of head and thorax yellowish brown; abdomen pale yellow.

Head very small, as wide as long, narrowed anteriorly, much elongated between the eyes, acuminate between basal segments of antennæ. Eyes dark, relatively large, occupying sides of head from close to base of antennæ almost to posterior edge of head; distance between eyes one-half the width of head; ocelli rather small and placed very far back between hind edge of eyes; anterior angle of triangle formed by ocelli is very obtuse; color pale yellow, margined inwardly, or entirely surrounded by red patches. Mouth cone very short and blunt; maxillary palpi short, three segmented. Antennæ one and three-fourths times as long as head, situated upon the elongated portion thereof; relative lengths of segments as follows:

$\frac{1}{4.5}$	$\frac{2}{6}$	$\frac{3}{7}$	$\frac{4}{6.5}$	$\frac{5}{6}$	$\frac{6}{8.3}$	$\frac{7}{2.8}$	$\frac{8}{3}$
-----------------	---------------	---------------	-----------------	---------------	-----------------	-----------------	---------------

First segment much compressed longitudinally; transverse diameter more than twice its length; two very strongly drawn out externally into a stout, conical elongation; segments three, four, and five rounded; three with a quite long peduncle; three and four each bear one stout, transparent sense cone upon outer angle. Color of one and two clear pale yellow; three to six becoming gradually more brownish; six to eight uniformly chestnut brown.

Prothorax one and one-third times as long as the head; anterior edge but slightly wider than hind edge of head; sides slightly concave, divergent so that width at posterior edge is more than twice that at anterior edge; hind angles acute, without long spines; sides quite deeply indented above fore coxæ. Sides of mesothorax rounded, converging anteriorly; metathorax narrower than mesothorax, its sides also rounded but converging posteriorly. Color of thorax light yellowish brown, sometimes splashed with red. Fore legs very short and extremely thickened; other legs short, but not thickened. Legs pale yellow, middle and hind tibiæ slightly brownish on upper side, basal part of fore femora shading to light brown. Wings long, sabre-formed, overreaching tip of abdomen, shaded with gray. Two long veins, the hind one branching from the fore at about one-third the length of the wing; both veins disappear before reaching the apex. Each vein bears four to six spines; basal third of wings unfringed; fore fringe sparse, long and slender.

Abdomen ovoid, acuminate at apex, broadly attached to metathorax, one and two-thirds times as long as broad. Spines upon last two segments very short and weak, and those upon ventral plates weak and inconspicuous. Ovipositor very short and weak, apparently not functional; tenth segment split open above. Color of abdomen uniformly clear pale yellow, except apex brownish and posterior edges of segments faintly brownish, receptaculum seminis over base of ovipositor bright reddish orange.

Described from three specimens.

Cotype.—Cat. No. 6325, U.S.N.M.

Male unknown.

Food plants.—*Fistula orina*, *Pop. pratinis*.

Habitat.—Amherst, Massachusetts.

Genus LIMOTHRIPS Haliday.

Body powerful. Head longer than wide, broadened behind, and in front of the eyes extending into a triangular projection upon which the antennæ are borne. Ocelli present in females, but wanting in males. Antennæ eight segmented; third segment drawn out into a blunt, triangular process at outer angle. Maxillary palpi two segmented (*L. cerealeum* three!). Prothorax somewhat shorter than the head, slightly broadened at hind edge; hind angles provided with

one long, stout spine. Legs rather short and thick. Wings quite long and of medium breadth; costa bearing a fringe; veins bearing a few short spines. Terminal segment of abdomen in female elongated somewhat and approaching a tubular form, split open above; each side bears a short, extremely stout spine and similar stout spines are borne upon the sides of the eighth segment.

Male entirely wingless. End of abdomen bluntly rounded; ninth segment bears a stout spine at middle of each side and a pair of similar spines stands closely together near the dorsal line above.

Species of this genus move slowly and have no power of leaping.

I found only the new species *avenæ* of the genus.

LIMOTHIRIPS AVENÆ, new species.

Plate I, figs. 10-12; Plate II, fig. 13.

Female.—Length 1.57 mm. (1.48 to 1.66 mm.); width of mesothorax 0.28 mm. (0.26 to 0.30 mm.). Form elongated, slender. General color dark yellowish brown.

Head a little longer than wide, tapering a little anteriorly; cheeks very slightly arched; surface of head not at all, or but very faintly, cross striated and bearing a few scattered minute spines; front strongly arcuate, produced considerably between bases of antennæ; color of head dark brown. Eyes of moderate size, black with yellow margins, triangular above, protruding slightly; ocelli fairly well separated, anterior one smallest, pale yellow with very dark red crescents on inner margins. Mouth cone short and moderately thick; maxillary palpi short, only two segmented. Antennæ rather short, about one and one-half times as long as the head, considerably separated at bases; relative lengths of segments as follows:

$\frac{1}{4.4}$	$\frac{2}{9.1}$	$\frac{3}{11.8}$	$\frac{4}{10.2}$	$\frac{5}{10.5}$	$\frac{6}{14.4}$	$\frac{7}{3}$	$\frac{8}{3.8}$
-----------------	-----------------	------------------	------------------	------------------	------------------	---------------	-----------------

Segment one much wider than long; two cup-shaped; three to five clavate; six fusiform; seven and eight slender, cylindrical; one and two dark brown; three to eight shading gradually from pale brownish gray to more or less dark brown; outer angles of three and four strongly developed (three especially so, though obtuse), and each bears one long pointed sense cone; six also bears one long, slender sense cone on inner side at two-thirds its length.

Prothorax a little shorter than head and about one and one-third times as wide as long; sides diverging from head posteriorly; only one long stout spine at each posterior angle; other spines scattered and minute; transverse margins nearly straight; sides slightly rounded; concolorous with head. Mesothorax about one and one-third times as wide as prothorax; metathorax abruptly narrower; sides nearly per-

allel; pterothorax more or less rusty brown in color. Wings present, quite long and slender, about one-seventeenth as broad in middle as long, tapering gradually from base to tip; two longitudinal veins in fore wing, the second branching from the first at about one-fourth its length; both veins and costa bear a few short, rather stout, dark brown spines: costa about twenty, fore vein about twelve, of which only two stand beyond the middle of the wing; hind vein about nine spines; fore wings dark, smoky gray; hind wings very slightly gray; costal fringes long. Legs rather short, but not thickened; femora and middle and hind tibiae dark brown; all tarsi, fore tibiae and extremities of middle and hind tibiae yellow; fore tibiae shaded with brown above; hind tibiae alone bearing stout spines.

Abdomen about two-thirds the length of the body and only about one-fourth as wide as long, almost cylindrical in form; segments not overlapping, width of segments increasing very gradually up to the sixth, then diminishing rapidly; last three segments conoid, prolonged at tip of tenth. Spines on sides of abdomen weak and inconspicuous before the seventh segment; eight bears three or four short, very stout, slightly curved, dark brown spines on each side; nine bears a circlet of long, slender spines; tenth segment split open above, sharply pointed at tip, and on each side above is a short, very stout, straight, dark brown spine reaching but slightly beyond the tip; color of abdomen gray-brown, shading to almost black at tip; connective tissue pale yellow; surface of segments finely reticulated.

Described from eight long-winged females.

otype.—Cat. No. 6826, U.S.N.M.

Male.—Length 1.05 mm. (1.02 to 1.08 mm.); width of mesothorax 0.22 mm. (0.20 to 0.22 mm.).

Head as broad as long. Ocelli generally wanting, though sometimes vestiges are present. Antennae only one and one-third times as long as the head; relative lengths of segments:

1	2	3	4	5	6	7	8
$\frac{1}{4}$	$\frac{2}{8}$	$\frac{3}{9.7}$	$\frac{4}{7.7}$	$\frac{5}{7.3}$	$\frac{6}{11}$	$\frac{7}{2.3}$	$\frac{8}{3}$

Color paler than in female, with more of a yellowish tinge, becoming yellowish brown at tip. Pterothorax without traces of wing pads; the dorsal plates very broad, being as wide as first abdominal segment. Head and thorax yellowish brown; legs yellow; femora and tibiae considerably shaded with brownish.

Abdomen but little more than twice as long as wide, though segments overlap considerably, giving it a yellowish brown and dark brown cross-banded appearance; bluntly rounded at tip; segment nine very large and bluntly conoid; segment ten small, cylindrical, and plainly visible protruding within the ninth; copulatory apparatus projecting a little beyond ten. Close together in middle of nine above stand two short, stout spines borne upon broader black, chitinous

projections, the inner edges of which are parallel and the black marking tapers to a point anteriorly; on each side of these peculiar processes stands a long, slender spine; at about the middle of each side of ninth segment is a very abrupt, angular, chitinous projection shaded almost black, supporting on the inside of it an exceedingly short, stout, dark brown, blunt spine; other spines on this segment slender, but not very long. Segment ten is blunt at end and bears a row of short, small spines above, close to hind edge; nine is cut out on upper side over about half of ten, which at tip does not quite reach to tip of nine or under side; abdomen yellow-brown.

Described from four specimens.

Cotype.—Cat. No. 6326, U.S.N.M.

Food plants.—Oats, *Festuca pratensis*.

Habitat.—Pennsylvania, Massachusetts.

Life history unknown.

This species was very abundant upon and caused much damage to oats at State College, Pennsylvania, during the summer of 1898.

Genus SERICOTHRIPS Haliday.

Body broad and having a silky luster due to the presence of numerous minute spines on the abdominal segments. Head fully one and one-half times as wide as long. Eyes large and protruding; ocelli present in both sexes. Antennæ eight segmented. Maxillary palpi three segmented. Prothorax much longer than the head, without long spines at hind angles (one present in *S. variabilis*). Legs, especially hind pair, quite slender. Wings either reduced or fully developed; when present, the fore wing is broad at basal fourth, the remainder being very narrow; only one longitudinal vein developed; fore fringe long; spines on veins numerous and moderately developed. Abdomen in some species strongly arched and its segments broad and short; tip of abdomen conical in both sexes. Abdomen of male much more slender throughout.

Species of this genus leap readily.

The characters of this genus are extended to include the following species:

SYNOPSIS OF SPECIES.

Body nearly black except segments four, five, and six of abdomen almost white; wings reduced *cingulatus* (p. 141)

Body yellow with brown or gray markings; wings present and with two spines on last fourth, where hind vein usually is *variabilis* (p. 143)

SERICOTHRIPS CINGULATUS, new species.

Plate III, figs. 27-29.

Female.—Length 1 mm. (0.84 to 1.25 mm.); width of mesothorax 0.25 mm. (0.22 to 0.31 mm.); width of abdomen 0.37 mm. (0.31 to 0.45 mm.). General color very dark brown; abdomen cross-banded with white in the middle.

Head narrow as compared with following segments, one-half as long as wide, widest through the eyes and constricted considerably behind them, neck-like and sunken slightly in the prothorax; front slightly depressed at the insertion of the antennæ. Eyes small, rounded, strongly protruding, occupying together only one-half the width of the head, black, coarsely granulated; margins light yellow; ocelli present, very small, well separated, not prominent; anterior one indistinct. Color of head brown; surface bearing scattered small curved spines. Mouth cone reaching to about the posterior edge of prosternum; maxillary palpi three segmented. Antennæ very nearly as long as head and thorax together, slender, eight-segmented; relative lengths of segments:

1	2	3	4	5	6	7	8
5.8	9.9	16.4	14.5	12.2	14.3	3.2	4.

Basal two segments thickest; spines slender and inconspicuous. Segments one, two, and three light yellow; third shaded with brown toward apex; remainder dark brown except four, which is yellowish at base and style is somewhat lighter brown.

Prothorax nearly twice as long as head and one and one-half times as broad as long; widest in middle, tapering abruptly to the head and less abruptly to posterior angles; surface marked with deep, transverse, reticulating wrinkles appearing like striæ in dorsal view; each anterior angle bears a pair of short, divergently curved spines; one short, anteriorly curved spine at each hind angle; color dark brown. Meso and metathorax together scarcely as long as prothorax, only slightly wider than prothorax; yellowish brown, except notal plates dark brown; sides of metathorax not converging posteriorly; metanotum much wider than long. Wings reduced, the pads reaching only to the first abdominal segment. Fore and middle legs of approximately same length; fore pair thicker; hind pair longest and quite slender; all femora shaded with brown in middle but lighter at extremities; tibiae yellowish brown, more yellow at basal attenuations, fore pair lightest; tarsi uniformly yellowish, slender, and tapering evenly from their bases to tips. Surface of all femora and tibiae thickly covered with transverse ridges; spines upon hind tibiae especially long and slender.

Abdomen very large, acutely ovoid, about one-half as broad as long, uniformly thickly covered with minute spines which appear most clearly as a fine fringe at posterior edge of each segment; a transverse dorsal row of about twelve quite uniformly long, brownish spines regularly spaced across the middle of segments two to six, and six similar spines stand in as many small, dark depressions along the posterior edge of the sternal plates of these segments. First three abdominal segments light brown; four, five, and six abruptly pale gray, or yellowish gray, tinged with brown in middle of dorsum, most broadly on sixth segment; last four segments again abruptly dark brown. A narrow, dark-brown, transverse, chitinous thickening

(appearing as a stripe) extends across two-thirds of the width of the dorsal plates of segments two to seven near their anterior edges; spines upon terminal segments short and weak.

This species possesses a well-developed power of leaping.

Described from twenty specimens.

Cotype.—Cat. No. 6327, U.S.N.M.

Male.—Length 0.87 mm. (0.66 to 1 mm.); width of mesothorax 0.21 mm.; width of abdomen, 0.27 mm. (0.22 to 0.30 mm.).

Relative lengths of antennal segments:

$\frac{1}{5.5}$	$\frac{2}{9.3}$	$\frac{3}{15}$	$\frac{4}{12.8}$	$\frac{5}{10.3}$	$\frac{6}{12.8}$	$\frac{7}{2.8}$	$\frac{8}{3.7}$
-----------------	-----------------	----------------	------------------	------------------	------------------	-----------------	-----------------

End of abdomen shaped as in female; a transverse elliptical depression in the middle of ventral plates of segments five to seven. Segment nine long and tapering; tenth elongate and retracted within the ninth. Genital apparatus appears to be wholly protrusile. Testes large and brownish yellow in color.

Cotype.—Cat. No. 6327, U.S.N.M.

Food plants.—Various grasses.

Habitat.—Amherst, Massachusetts.

Life history unknown.

SERICOTHRIPS VARIABILIS (Beach).

Plate II, fig. 23; Plate III, figs. 24-26.

Thrips variabilis BEACH, Proc. Iowa Acad. Sci., 1895, III, 1896, pp. 220-223.

Female.—Length 0.84 to 1.23 mm.; width of mesothorax about one-fourth the length of the body. General color yellow, with more or less striking brown or gray-brown markings.

Head about two-thirds as long as broad, broadest through eyes, retracted considerably into prothorax; cheeks moderately full, converging somewhat posteriorly; anterior margin nearly straight, but slightly elevated between bases of antennæ. Spines upon head inconspicuous; but one moderately long spine on each side of fore ocellus, and one behind each hind ocellus; a row of four short, strongly curved spines across front near margin, and a few small spines upon cheeks; color of head pale yellow with dusky shadings. Eyes moderately large, protruding a little, nearly black, coarsely faceted, plainly pilose, occupying about three-fifths the width of the head; ocelli large, approximate, reddish orange, heavily margined inwardly with maroon, situated upon a slightly raised area between the eyes. Mouth cone tipped with black; maxillary palpi slender, three segmented. Antennæ eight segmented, more than twice as long as head, bases separated by about two-thirds the width of a basal segment; relative lengths of segments:

$\frac{1}{5}$	$\frac{2}{8.2}$	$\frac{3}{12.7}$	$\frac{4}{12}$	$\frac{5}{10}$	$\frac{6}{11.7}$	$\frac{7}{2.7}$	$\frac{8}{3}$
---------------	-----------------	------------------	----------------	----------------	------------------	-----------------	---------------

Segment one nearly spherical and slightly narrower than two which is broadest; three and four fusiform; five similarly formed to four at its base, but quite broad at its apex, and rather broadly joined to six which with style tapers gradually to tip. Color: One white and nearly transparent; two pale or brownish yellow; three and four pale yellow; three light brownish at tip and four in outer half; remainder of antenna light to dark brown, base of five somewhat lighter.

Prothorax about three-fourths as long as wide, a little longer and a little wider than the head; sides about parallel; angles rounded; transversely striated on dorsum; only one long, slender spine at each hind angle; anterior third of pronotum concolorous with head, remainder marked with a saddle-shaped patch of brown, the anterior edge of which is concave and sharply defined; six or eight medium-sized spines stand in this dark border, behind it there are six more or less well-defined brown spots. Pterothorax large and apparently symmetrically formed on account of first segment of abdomen being closely joined to metathorax and closely approaching it in color; meso and metathorax equally wide and about one and one-half times as wide as the prothorax; metanotal plate light brown; rest of pterothorax bright or dusky yellow, except small brown spots at anterior edge of mesonotum and at anterior angles. Wings long, reaching to tip of abdomen; fore wings very slender beyond the basal fourth, breadth at middle only about one twenty-sixth their length; only the fore longitudinal vein is fully developed, though vestiges of the hind vein may be seen at the base. Spines upon costa and fore veins dark brown and conspicuous; twenty-two to thirty on costa; twenty to twenty-six on fore vein placed at regular intervals; two isolated spines stand upon the last fourth of the wing on the line where the hind vein might be expected; the scale bears four spines along its inner edge and one discal near its base. Fore wings uniformly dusky or marked with three white and two gray-brown cross bands alternating; scale also gray-brown; anterior fringe long and fine on outer two-thirds of costa. Legs, especially hind pair, quite long and slender; general color pale yellowish with brown markings on fore femora above, both outer and inner sides of fore tibiae, around outer halves of middle and hind femora, around middle of these tibiae, and bases of all bladders. Tarsi slender and tapering; hind tibiae without stout spines within.

Abdomen cylindrical, tapering sharply from anterior edge of eight, or acute avoid; two to two and one-third times as long as broad; thickly clothed with minute slender spines appearing most prominently as a fringe on hind edges of dorsal plates. Eight to ten spines upon each segment from two to eight, two or three of these stand quite closely together in a group upon each side, and the middle pair stand very closely together upon segments two to five, but separate more widely upon following segments and become larger; spines upon last two seg-

ments short, weak, and not strongly radiating. Segments two to seven marked with a very prominent dark-brown cross line at anterior third of each; on each side of these segments behind this line is a more or less extensive brown shading which on seven extends clear across the back; ground color of these segments is white or pale yellowish gray; eight, nine, and ten are without the brown markings, and are pale or dusky yellowish.

Male.—Similar to female with the following exceptions: Length 0.64 mm.; width of thorax 0.19 mm.; abdomen only four-fifths as wide as thorax, and more than twice as long as wide, nearly cylindrical to seventh segment; eight to ten conoid; spines upon last segment short; the testes large and brownish orange.

Relative lengths of antennal segments:

$$\frac{1}{4} \quad \frac{2}{7} \quad \frac{3}{10.3} \quad \frac{4}{10} \quad \frac{5}{9} \quad \frac{6}{10.5} \quad \frac{7}{2} \quad \frac{8}{3}$$

Var. a. female.—Head and front third of prothorax clear, pale yellow; pterothorax darker yellow; hind part of prothorax and metanotum abruptly brown; abdomen pale yellowish with very conspicuous dark brown cross-streak at first third of segments two to seven; on each side behind this streak is a narrow brown shading which upon seven extends clear across the back. Fore wings slightly tinged with yellowish, darkest at base. Brown spot on femora above, darkest on hind femora. Abdomen acute ovoid.

Food plants.—Clematis, clover, elm, hackberry.

Habitat.—Iowa, Massachusetts.

"*Var. b. male and female*.—Body pale yellowish, immaculate; apical joints of antennæ black, remainder pale; wings and fringes tinged with yellowish."—Beach.

Food plants.—Hawthorn, hackberry.

Habitat.—Iowa.

"*Var. c. male and female*.—Wings nearly uniformly fuliginous; last three joints of antennæ, distal half of joints 4 and 5 black, sometimes intermediate altogether dusky; brown markings very distinct, confined to two large spots on thorax and scutellum respectively, the latter oblong and approximating posteriorly; abdomen immaculate." Beach.

Food plants.—Hawthorn, hackberry.

Habitat.—Iowa.

"*Var. d. male and female*.—This variety is characterized by having the wings fuliginous, trifasciate with white bands, and in being more

"I have seen and studied the specimens of Miss Beach labeled "*Thrips variabilis* Beach, Var. c. male and female types." These specimens seem to me to fit much better her description of "Var. d." An emended description based upon these specimens would not be distinguishable from the foregoing description of "Var. d."

heavily marked with brown; the markings on the thorax and bands at bases of first, second, and third (sometimes of second and third only), and seventh and eighth segments of the abdomen are extended until they coalesce and form broad bands; the dorsal surface of the head is brown; sometimes all of the caudal segments are brown; the legs are white, with brown streaks on dorsal surface of femora, and frequently on tibiae also; antennae same as in preceding variety." Beach.

Food plants.—Cucumber, grass, smartweed.

Habitat.—Iowa, Massachusetts.

PSEUDOTHRIPS, new genus.

Head much broader than long. Ocelli present. Maxillary palpi three segmented. Antennae eight segmented (apparently nine segmented, owing to an apparent division of the sixth segment). Prothorax much longer than head and somewhat broadened posteriorly; one stout spine at each hind angle. Wings with two longitudinal veins which, with the costa, are thickly and regularly set with quite prominent spines; fore fringe well developed. Abdominal segments two to eight, inclusive, bear across the middle of each dorsal plate four weak spines, of which the middle two are close together upon anterior segments but diverge posteriorly.

This genus is erected for the single species *inequalis*.

($\psi\epsilon\upsilon\delta\omega$, false; $\theta\rho\upsilon\psi$.)

PSEUDOTHRIPS INEQUALIS (Beach).

Plate III, figs. 30-32.

Thrips inequalis BEACH, *Proc. Iowa Acad. Sciences*, 1895, III, (1896), pp. 223-224.

Femur.—Length 0.88 mm.; width of mesothorax, 0.22 mm.; general color yellow; thorax and abdomen tinged with orange.

Head fully one and one-half times as broad as long, slightly constricted at hind edge, and retracted into the prothorax somewhat; cheeks full; anterior margin nearly straight. Eyes of medium size, rounded, slightly protruding, slightly pilose; ocelli large, well separated, with orange-red margins; ocellar bristles present, but not very long or prominent. Mouth cone moderately sharp and somewhat shaded with brown at tip; maxillary palpi three segmented. Antennae over two and one-half times as long as head; eight segmented, though there appear to be nine segments; relative lengths of segments as follows:

$$\begin{array}{ccccccc} \frac{1}{4} & \frac{2}{7} & \frac{3}{8.5} & \frac{4}{8.5} & \frac{5}{8} & \frac{6}{8+2} & \frac{7}{2} & \frac{8}{3} \end{array}$$

Segment six has a distinct annulation around it at four-fifths its length, the outer part appearing much like a separate segment. Segments one and two quite stout and rounded; three irregularly, and four regularly clavate; seven and eight cylindrical. Segment one paler than two, concolorous with head; three to six pale yellow in

basal parts, shading to dark brown toward the tips; seven and eight dark brown; spines distinct but not prominent, becoming more slender toward the tip.

Prothorax about one and one-half times as long as head, and one and one fourth times as broad at posterior edge; sides nearly straight, diverging backward; dorsal surface bearing a number of small, dark spines, mostly near lateral and posterior borders; one stout, prominent spine at each hind angle. Mesothorax over one and one-half times as wide as head; sides rounded and converging anteriorly; fore angles prominent. Metathorax but little narrower than mesothorax; its sides nearly parallel, curving inward abruptly at hind angles. Wings reaching almost to tip of abdomen; two longitudinal veins quite prominent; both veins and costa thickly and regularly set with prominent dark brown spines; costal twenty-four to twenty-eight, fore vein eighteen to nineteen, hind vein ten to eleven, scale five, internal one. Fore wing about one-fifteenth as broad in middle as long, shaded faintly yellowish; costal fringe well developed. Legs dusky yellow, quite slender; fore femora slightly thickened; femora and tibiae bearing numerous short spines; inner side of hind tibiae with but few stouter spines except one pair at tip; each hind tarsal segment with one stout, dark spine on the side; a dark brown spot on under side of each tarsus at tip.

Abdomen elongate-ovate; few dark spines along the sides; segments two to eight bear across the middle of each dorsal plate four weak spines, the middle two are closed together upon anterior segments, but diverge posteriorly; posterior edge of nine bears a circle of six stout spines, the median pair being only slightly more than half as long as the others. All spines on body, and spines and fringes on wings conspicuously dark brown; abdomen dusky yellow, dark brown at extreme tip.

Redescribed from one female, "Type" of Miss Beach.

Male unknown.

Food plant.—Aster.

Habitat.—Ames, Iowa.

This species bears a close general resemblance to *Euthrips tritici*, with which it was taken.

Genus EUTHRIPS Targioni-Tozzetti.

PHYSOPUS.^a

Ocelli usually present but sometimes more or less rudimentary. Antennæ eight segmented. Maxillary palpi three segmented. Pro-

^aThe name *Physopus* was used by Amyot and Serville for this genus in 1843, but it can not hold, as this name was previously used by Leach for a genus of the Neuroptera in 1817.

I have been unable to see Targioni-Tozzetti's characterization of his genus *Euthrips*, but as nearly as I can tell it may include the species which have been placed in the genus *Physopus*, and I therefore adopt it for this genus.

thorax as long or somewhat longer than the head, with two long spines upon each hind angle and one similar spine upon each anterior angle in many species, but this is wanting in others. Legs usually unarmed, but in a few species with a stout tooth on under side of fore tibia at end. Wings usually fully developed but sometimes reduced. When present they are moderately broad, have two longitudinal veins which are set with numerous stout spines at regular intervals in those species having a spine at the fore angle of the pronotum. Spines upon abdomen moderately stout; anal spines long and slender.

These species are active and can spring.

SYNOPSIS OF SPECIES.

- | | | | |
|---|---|---|-------------------------------|
| 1 | { | General color of body yellow | 2. |
| | { | General color of body brown | 3. |
| 2 | { | Fifth antennal segment about five-sixths as long as four | <i>occidentalis</i> (p. 152). |
| | { | Fifth antennal segment about two-thirds as long as fourth | <i>tritici</i> (p. 148). |
| 3 | { | Antennæ about three times as long as head | <i>fuscus</i> (p. 154). |
| | { | Antennæ but slightly more than twice as long as head | <i>neruosus</i> (p. 155). |

EUTHRIPS TRITICI (Fitch).

WHEAT THRIPS.

Plate IV, figs. 36-39.

- Thrips tritici* FITCH, Count. Gent., VI, Dec. 13, 1855, p. 385.
Thrips tritici FITCH, Rept., II, Nox. Ins. N. Y., 1857, pp. 804-808.
Thrips tritici ASHMEAD, Orange Insects, 1880, p. 72.
Thrips tritici OSBORN, Canad. Entom., XV, 1883, pp. 152, 156.
Thrips tritici OSBORN, Trans. Iowa St. Hort. Soc., XVIII, 1883-1884, pp. 520-521;
 Coll. Bull., 2, Iowa Agr. College, 1885, pp. 96, 97.
Thrips tritici HUBBARD, Ins. Affect. Orange, 1885, p. 164, fig. 77, pl. xi, fig. 5.
Thrips tritici FORBES, Centralia, Ill., Sentinel, 1887; Prairie Farmer, June 4, 1887.
Thrips tritici LINTNER, Cult. and Count. Gent., LII, June 9, 1887, p. 459.
Thrips tritici WEED, Prairie Farmer, LIX, 1887, p. 343; Trans. Ill. St. Hort. Soc., 1887, pp. 230-233.
Thrips tritici OSBORN, Insect Life, I, 1888, p. 141.
Thrips tritici WEED, Popular Gardening, III, 1888, p. 176.
Thrips sp. COMSTOCK, Bull. XI, Cornell Agr. Exp. Sta., 1889, p. 131.
Thrips tritici RILEY-HOWARD, Insect Life, I, 1889, p. 340.
Thrips tritici FORBES, 16th Rept. St. Entom., Ill., 1890, p. ix, pl. v, fig. 4; 17th Rept. St. Entom., Ill., 1891, pp. xiii, xv.
Thrips tritici WEED, Ins. and Insecticides, 1891, p. 95.
Thrips tritici FORBES, Insect Life, V, 1892, pp. 126, 127.
Thrips tritici WEBSTER, Bull. 45, Ohio Exp. Sta., 1892, pp. 207, 208.
Thrips tritici TOWNSEND, Canad. Ent., XXIV, 1892, p. 197.
Thrips tritici BRUNER, Rept. Nebr. St. Bd. Agr., 1893, (1893), p. 457, fig. 96.
Thrips tritici BRUNER, Nebr. St. Hort. Rept., 1894, (1894), pp. 163, 214, fig. 82.
Thrips tritici ASHMEAD, Insect Life, VII, 1894, p. 27.
Thrips tritici CRAW, 4th Biennial Rept. St. Bd. Hort., Calif. for 1893-94, 1894, p. 88.
Thrips tritici WEED, Ins. and Insecticides, 1895, p. 146.
Thrips tritici UZZEL, Mon. d. Ord. Thysanoptera, 1895, pp. 220, 278.
Thrips tritici SMITH, Economic Entom., 1896, p. 102, fig. 73.

Thrips tritici LINTNER, 11th Rept. N. Y. St. Entom., 1896, pp. 247-250.

Thrips tritici ROLFS, 10th Ann. Meet. Fla. St. Hort. Soc., 1897, p. 97.

Thrips tritici QUAINANCE, Bull. 42, Fla. Agr. Exp. Sta., 1897, pp. 552-564.

Thrips tritici POWERS, Fla. Farmer and Fruit Grower (editorial), March 27, 1897.

Thrips tritici QUAINANCE, Bull. 46, Fla. Agr. Exp. Sta., 1898, pp. 77-103, figs. 1-9.

Thrips tritici HOWARD, Bull. 18, N. S., U. S. Dept. Agri., 1898, p. 101.

Thrips tritici ROLFS, 11th Ann. Meet. Fla. St. Hort. Soc., 1898, pp. 34-38.

Female.—Length about 1.22 mm.; width about 0.26 mm. General color brownish yellow, thorax tinged with orange.

Head three-fourths as long as broad and four-fifths as long as prothorax, but slightly withdrawn therein; cheeks but slightly arched behind the eyes and converging slightly posteriorly; anterior margin very nearly straight; back of head transversely striated. Eyes large, dark, and slightly pilose, occupying together about three-fifths the width of the head; ocelli present, sub-approximate, pale yellow, margined inwardly with bright reddish orange crescents; spines between ocelli on each side long and conspicuous; post-ocular spines shorter. Maxillary palpi three segmented. Antennæ nearly two and one-half times as long as the head; relative lengths of segments:

$$\frac{1}{6} \quad \frac{2}{8.7} \quad \frac{3}{13} \quad \frac{4}{12.3} \quad \frac{5}{8.8} \quad \frac{6}{12.5} \quad \frac{7}{2.2} \quad \frac{8}{4}$$

Color: One pale yellow; two light brown, base sometimes yellowish; three light yellow in basal half, remainder shaded light brown; four and five brown, yellowish at bases; six, seven, and eight brown. Spines upon antennal segments, especially two to five, quite stout and conspicuous.

Prothorax rather rounded, three-fourths as long as broad; one pair of stout spines at each angle, also one short anteriorly directed spine standing close to lower one of each fore pair; between each posterior pair and median line stands a row of five spines, number four alone being large; color of prothorax pale orange-yellow. Mesothorax rounded at anterior angles; mesonotal plate with one stout spine at each lateral angle and two pairs of small spines on posterior margin. Metathorax tapering but slightly posteriorly; metanotal plate bearing four spines close together at anterior edge, the middle pair being much more stout and conspicuous. Wings nearly reaching the end of abdomen; breadth at middle about one-twelfth their length; shaded but slightly; each fore wing has two longitudinal veins extending from base to tip of wing; spines on veins at regular intervals; costa twenty-six to twenty-eight; fore vein twenty to twenty-two; hind vein fifteen to eighteen; scale five, interior of scale one; a light, sparse fringe on costa of each wing; posterior fringes heavy and wavy. Legs clear pale yellow, sometimes slightly shaded with light brown above, quite thickly set with short brown spines; a pair of stout spines at extremity of each tibia; rows of spines on inner side of hind tibiae rather weak.

Abdomen cylindrical-ovate, pointed at the apex; dark brown stripe across segments two to seven near their anterior edges; dorsal plates, except nine and ten, shaded more or less with brown; three or four moderately stout brown spines stand out prominently upon the pale yellow sides of segments two to eight; terminal spines long, stout, and dark colored; tip of abdomen dark brown.

Redescribed from eight females.

Male.—Length about 0.7 mm. (0.64 to 0.80 mm); width of mesothorax 0.195 mm. (0.18 to 0.22 mm.). General color pale yellow, darkest upon pterothorax.

Eyes somewhat smaller than those of female. Antennæ about two and one-third times as long as the head. Relative lengths of segments as follows:

$\frac{1}{4.3}$	$\frac{2}{8}$	$\frac{3}{11}$	$\frac{4}{10.3}$	$\frac{5}{7.9}$	$\frac{6}{10.1}$	$\frac{7}{1.6}$	$\frac{8}{2}$
-----------------	---------------	----------------	------------------	-----------------	------------------	-----------------	---------------

Wings large and reaching beyond the tip of the abdomen. End of abdomen (ninth segment) bluntly conical; tenth segment retracted and not reaching the tip of the ninth; nine bears four pairs of long, stout, dark spines, of which one pair stands on each side near the anterior end of the segment, and one pair on each side near the tip; near the middle above stand two short spines.

Described from four specimens.

Food plants.—Alfalfa, apple, asparagus, aster (cultivated), bindweed, blackberry, buttercup, canna, cherry, clover, cone-flower, dandelion, dog-tooth violet, English pea, goldenrod, grasses, hardhack, heal-all, heliotrope, honeysuckle, hydrangea, lilies, mesquite, orange, pea, peach, pear, pink, plum, potato, raspberry, red clover, rose, shrubby *Althea*, smartweed, *Solidago bicolor*, *Spiranthes simplex*, squash, strawberry, sunflower, sweet william, wheat.

Habitat.—California, District of Columbia, Florida, Illinois, Iowa, Massachusetts, New Hampshire, New Jersey, New Mexico, New York.

The following descriptions of early stages are taken from Quaintance:

Egg.—Size 0.25 by 0.1 mm.; clear whitish in color; oblong, curved in shape.

Larva, first stage.—Length about 0.5 mm.; width of thorax nearly 0.1 mm.; body fusiform, gradually tapering caudad from fifth or sixth abdominal segment. Color, clear whitish; eyes reddish. Antennæ distinctly four-jointed; basal joint cylindrical, short; second somewhat urn-shaped, with distinct distal rim, about as long as broad; third joint conical, apex of cone united to second; fourth fusiform, widest near basal fourth, quite as long as other three joints together. Joints two, three, and four ringed, two and three rather obscurely, but on fourth joint the rings are quite pronounced, where, on distal part, they

appear to divide the joint into short, cylindrical segments. On the fourth joint the rings are minutely setate. Numerous large setæ are also present on all joints, most numerous on fourth. Legs stout; hind femur about as long as tibia; tarsus one-jointed, terminating in claw-like fork; bladder-like expansion of adults apparently wanting. Abdomen composed of ten segments, marked dorsally with four longitudinal rows of setæ and a row on each side. All of these setæ appear to be somewhat enlarged and rounded distally, except one pair on dorsum of last segment. On tenth segment these setæ are quite long, being from two to four times longer than the others.

Larva, second stage.—Length about 1 mm.; width of thorax about 0.22 mm.; shape about as in stage one. Color of body deep orange yellow; legs and antennæ lighter; eyes reddish; antennæ four-jointed, as in first stage; basal joint short, cylindrical, about one-half as long as wide; second, subcylindrical, somewhat longer than wide; third, subconical, about a third longer than wide; fourth, about as long as proximal three together, fusiform, thickest about basal fourth. Joints three and four plainly ringed, the rings of fourth joint quite distinct and minutely setate, as in first stage. Large setæ are also present about as in stage one. Femur of hind legs about as long as tibia; tarsus one-jointed, somewhat forked distally, and bearing a membranous expansion.

Nymph or pupa, young nymph.—Resembles the full-grown larva in shape; in color it is much lighter, being light yellow, with legs, antennæ, and wing-pads still lighter. Eyes reddish.

In the antennæ, legs, and wing-pads the nymph skin appears somewhat as a sheath to these parts of the forming adult. The antennæ are three or four jointed, apparently, thick and clumsy. The basal joint is large, swollen, slightly longer than wide; the second is about twice as long as wide and somewhat constricted in middle. Third joint is about a third longer than second, gradually tapering distally to an obtuse end. When the nymph stage is first entered the antennæ project cephalad in normal position. In six or eight hours, however, they are laid back over the head and prothorax. In the hind legs, femur and tibia of about equal length; tarsus indistinctly one-jointed, very short, and rounded distally. Wing-pads short, scarcely reaching caudal end of second abdominal segment, bearing one or two setæ. Abdomen as in larva, with dorsal and lateral rows of setæ, which, however, are acute. On the dorsum of ninth segment, near caudal margin, are four stubby, hook-like processes, curving cephalad, which appear to be the four modified setæ of this region.

Mature nymph.—Length about 1 mm.; width of thorax about 0.22 mm.; color light yellow; shape very similar to that of adult Thrips. Nymph skin more or less separated from the body of the adult within, particularly so in the legs, antennæ, mouth-parts, wing-pads, and

caudal end of abdomen. The wing-pads reach to about the sixth segment.

Life history.—"The life cycle of *Thrips tritici* is quite short, requiring but twelve days. Eggs are deposited in the tissues of infested plants, and hatch in three days. The larval state lasts for about five days, during which time the insect makes two molts, the second when entering the nymph stage. The nymph stage continues for about four days, during which time they take no food, rarely move to any extent, but remain hidden away."

Economic considerations.—This is one of the most widely spread and generally injurious species in this country. The specimens from which Fitch described the species were taken at Geneva, Wisconsin, from a wheat field which was being injured by the little pests. At various times it has been noticed swarming in the blossoms of orange and causing injury thereto. It is a very common species on a large number of flowering plants, both wild and cultivated, but unless present in great numbers their injuries are likely to pass unnoticed. By far the greatest damage appears to be done to strawberries, in the blossoms of which they swarm, and by their punctures of the essential parts of the flower they prevent its fertilization and the consequent development of the fruit. This failure of bloom, though perhaps produced at times by other insects and in other ways, is known to growers as "buttoning." The most serious injuries have been reported from Florida and Illinois. In Florida the strawberry crop in some sections has been reduced to one-third in dry seasons.

EUTHRIPS OCCIDENTALIS Pergande.

Thrips sp. COQUILLETT, *Ins. Life*, IV, 1891, p. 79.

Euthrips occidentalis PERGANDE, *Ins. Life*, VII, 1895, p. 392.

Femule.—Length about 1 mm.; width at mesothorax about one-fourth the body length. General color head pale lemon yellow, thorax orange yellow, abdomen brownish yellow.

Head about one and one-third times as broad as long, three-fourths as long as the prothorax and considerably withdrawn into the latter. Eyes rather large, occupying together about three-fifths the width of the head, dark, slightly pilose; ocelli subapproximate, pale yellowish, margined with reddish orange crescents; one very prominent spine between ocelli on each side; post-ocular spines very conspicuous. Maxillary palpi three segmented. Antennæ about two and one-half times as long as the head; first segment slightly shorter than the style; two is one and one-half times as long as one; three is longest; four is six-sevenths as long as three; five is five-sixths as long as four; six nearly as long as three; seven very short, about one-fourth as long as five; eight is one and three-fifths times as long as seven. Color of one translucent whitish; two brownish yellow (uniform), basal parts of

three, four, and five pale yellowish; apical parts shading quite abruptly to light brownish; six uniformly brown; style slightly lighter than six. Spines upon antennal segments, especially two to four, are unusually stout and prominent.

Prothorax nearly one and one-third times wide as long; color intermediate between that of head and pterothorax. One pair of prominent, stout spines at each angle; one short anteriorly directed spine close to the lower one of each fore pair; a row of five small spines (the fourth is stoutest) stands on each side of hind margin between pair at angle and median line. Anterior angles of mesothorax rounded; metathorax slightly narrower than mesothorax, its sides nearly straight and parallel; mesonotal plate bears one stout spine at each lateral angle and two pairs of small spines on posterior margin; metanotal plate bears two pairs of spines close to anterior edge, the middle pair being much the stouter; color of pterothorax bright orange. Wings very slightly yellowish; both longitudinal veins extend from base to tip of wing; both internal and the costal veins bear very stout, brown spines set at regular intervals; costa twenty-four to twenty-six, fore vein nineteen to twenty-two, hind vein fifteen to eighteen, scale five, internal on scale one. Fringe upon costal edge is very light, that upon hind edge is long and wavy; cross veins can sometimes be seen between the longitudinal veins and between the fore and costal veins at about two-fifths their length from base and sometimes a third at about four-sevenths between the fore and costal veins. Legs uniformly concolorous with head, bearing numerous small spines; a pair of strong spines at inner side of tip of each tibia.

Abdomen elongate-ovate in outline, conical at apex; a transverse, narrow, brown band extends across anterior part of segments three to seven; brownish tinge on abdomen fades behind sixth segment leaving only the apex of the cone brown; a group of three or four stout spines stands upon each side of segments two to eight; terminal spines long, stout; all spines brown.

Male.—Length about 0.65 mm.; width about 0.17 mm. Lighter in color than the females; nearly a uniform lemon yellow, slightly darker on throat; form more slender; apex of abdomen blunt, terminated on sides by two pairs of long, stout, inward curving spines; ninth segment also bears two pairs of very long, stout spines near its posterior border and near the dorsal line on this segment is a pair of short spines; the brown bands across the abdomen of female are wanting in males and they have fewer spines on sides of segments; the bright orange-colored testes are very prominent.

Food plants.—Apricot, orange, potato, and various weeds.

Habitat.—California.

Redescribed from specimens at the U. S. Department of Agriculture, Division of Entomology—presumably types.

Remarks.—This species is very similar to *Euthrips tritici* (Fitch), but it has a longer though more retracted head, which is also slightly wider; the terminal segment of the antenna is one and three-fifths times as long as seven; spines on body stouter and more prominent. Both *Euthrips tritici* and *Euthrips occidentalis* approach very closely to *Physopus nigriventris* Uzel.

EUTHRIPS FUSCUS, new species.

Plate IV, figs. 40, 41.

Female.—Length 0.93 mm. (0.70 to 1.08 mm); width of mesothorax 0.21 mm. (0.18 to 0.24 mm.). General color brown. In dark specimens the abdomen is blackish brown; in light specimens the general color is yellowish brown.

Head about one and one-half times as wide as long, about one-fourth retracted into prothorax; occiput deeply wrinkled transversely; anterior margin of head slightly and smoothly elevated in middle; cheeks straight and parallel. Eyes moderately large, occupying together about one-half the width of the head, dark, slightly protruding; margins pale yellow; ocelli smaller than facets of eye, pale yellow, margined with dark red, widely separated, posterior ones contiguous with yellow margins around eyes; one stout spine in front of each posterior ocellus. Mouth cone short and tapering abruptly; maxillary palpi slender, three segmented. Antennæ inserted a little below the margin, about three times as long as dorsal length of head; relative length of segments:

$\frac{1}{5.5}$	$\frac{2}{8.8}$	$\frac{3}{10.4}$	$\frac{4}{10.2}$	$\frac{5}{9}$	$\frac{6}{11.7}$	$\frac{7}{2.3}$	$\frac{8}{3.3}$
-----------------	-----------------	------------------	------------------	---------------	------------------	-----------------	-----------------

First segment rounded, one-third broader than long; two is cup-shaped; three to six subequal in thickness; three to five somewhat clavate; three with very slender peduncle; six cylindrical-ovate. Antennæ quite uniformly brown (sometimes three, four, and five lighter gray-brown, especially at bases), only segment three somewhat more yellowish; spines on segments two to five quite stout and dark colored. Color of head uniform grayish to orange-brown.

Prothorax fully one and one-half times as wide as long and one and two-fifths times as long as the head; sides arched; angles rounded; wider behind than in front; one large curved spine at each anterior angle and another on anterior margin between this and the median line; two stout spines at each posterior angle, the inner one of which is much the weaker; also a stout spine on the posterior edge between the pair and the median line; other spines on prothorax small and not conspicuous. Mesothorax but very little wider than the prothorax; projecting prominences at anterior angles; mesonotum broad, without

prominent spines; posterior edge nearly straight for one-third the width of the segment; metathorax narrows abruptly after the anterior edge till narrower than prothorax, then sides run nearly parallel to abdomen; mesonotum with two pairs of spines near anterior edge, the outer one of each pair being much less stout than the inner one; mesothorax and metathorax together not longer than the prothorax. Wings reduced, barely reaching to the first abdominal segment; pads set with several stout spines. Legs of medium length and of moderate size, quite thickly set with short bristles, concolorous with, or usually lighter than body; bases of posterior femora and inner sides of posterior tibiae more yellowish; thorax colored nearly like head.

Abdomen one and one-half times as wide as the mesothorax (short-winged female) and twice as long as broad, or nearly twice as long as head and thorax together; elliptical in outline except that apex is conical; broad, dark bands cross the abdomen at the anterior edge of dorsal plates on segments two to eight. Each segment except one and ten bears two or three short, stout spines on sides; in addition to these nine bears a circlet of eight unusually long, strong spines, and ten also bears a circlet of six long spines though these are somewhat shorter than those on previous segment. Segment ten is split open above; color of abdomen yellowish brown to brown-black, usually considerably darker than head and thorax; segments usually more or less telescoped.

Described from eighteen short winged females taken in hibernation in February and November.

Cotype.—Cat. No. 6328, U.S.N.M.

Food plant.—Grass?

Habitat.—Massachusetts.

Life history unknown.

EUTHRIPS NERVOSUS (Uzel).

Plate III, figs. 33, 34; Plate IV, fig. 35.

Physopus nervosa UZEL, Monographie d. Ord. Thysanoptera, 1895, p. 102.

Thrips (Euthrips) maidis BEACH, Proc. Iowa Acad. Sciences, 1895, III (1896), pp. 219, 220.

Female.—Length 1.33 mm. (1.22 to 1.39 mm.); width of mesothorax 0.32 mm. (0.28 to 0.34 mm.). General color dark yellowish brown.

Head somewhat pentagonal in form, not as long as wide; cheeks straight and converging slightly posteriorly; front broad and obtusely angular; back of head transversely wrinkled and bearing a few minute spines. Eyes rather small, black with light yellow borders, rounded or oval in outline; ocelli yellow, widely separated, posterior ones contiguous with light borders around eyes; one very long slender spine on each side midway between ocelli. Mouth cone pointed, tipped

with black; maxillary palpi three segmented. Antennæ slightly more than twice as long as head and very slender beyond second segment; comparative lengths of segments as follows:

1	2	3	4	5	6	7	8
$\frac{1}{6}$	$\frac{2}{10}$	$\frac{3}{14}$	$\frac{4}{12.5}$	$\frac{5}{11.4}$	$\frac{6}{15.3}$	$\frac{7}{3}$	$\frac{8}{4}$

Color of antennæ dark brown, except segments three and four and extreme base of five abruptly yellow. Spines on first segments quite dark and conspicuous, becoming paler and more indistinct toward the tip.

Prothorax approximately as long as head and a little wider, almost rectangular in form, bearing many prominent spines; one at each fore angle and two at each hind angle are longest; one half way between fore angle and median line on front margin and one similarly placed on hind margin are intermediate in size; numerous others are smaller. Color of head and prothorax dark brown. Mesothorax approximately as wide as length of antennæ; front angles obtusely rounded; metanotal plate bears four spines close to front edge, the middle pair being large and prominent, the others small; pterothorax yellowish brown. Wings present, fully as long as the abdomen, about one-twelfth as broad as long, sharply pointed at ends; surface of wings thickly covered with minute, dark-colored spines; both longitudinal veins and costa of fore wing thickly and regularly set with quite long, dark-colored spines; costa has from twenty-five to twenty-nine, fore vein from sixteen to twenty-two, hind vein from fourteen to sixteen; fore wings shaded with gray; veins not prominent; costal fringe of fore wings weak and less than twice as long as costal spines. Legs moderately long, not thickened; femora dark brown, yellow at extremities; tibiæ and tarsi yellow; tibiæ shaded more or less with brown around middle and tarsi with prominent dark brown spot at tip within; each tibia with a pair of prominent, dark brown spines at tip within and a row of from five to seven short brown spines on inner side of hind tibiæ.

Abdomen about two and one-half times as long as width of mesothorax, somewhat cylindrical in shape, but enlarging from base to hind edge of second segment and tapering evenly from eighth segment to tip. Spines along sides and around tip of abdomen very dark brown and conspicuous; those on segments nine and ten are long and subequal on both segments. Color of abdomen dark brown, shading toward tip; connective tissue yellow; last segment split open above.

Redescribed from six females; no males found. Compared and identified with *Thrips* (*Euthrips*) *maidis* Beach.

Food plants.—Corn, various grasses (first spring flowers, Uzel).

Habitat.—Bohemia (Uzel); Ames, Iowa; Amherst, Massachusetts.

Life history unknown, except that it hibernates in turf.

SCOLOTHRIPS, new genus.

Head wider than long, retracted considerably into prothorax. Eyes protruding; ocelli present. Maxillary palpi three segmented. Antennæ short and thick; sense cones very long. Prothorax slightly longer than head and somewhat broadened posteriorly. Spines arranged as follows: One at each anterior angle, one halfway between these angles and the median line, one at the middle of each side, two at each hind angle, and one between this pair and the middle of the hind margin. Wings present, slender, with two longitudinal veins and ring vein strongly developed; fore fringe very weak but spines on veins very strong. Intermediate abdominal segments with one spine on each side at the hind angle.

This genus is erected for the species *6-maculatus*.

(σκαλος, prickly or thorny; θριψ.)

SCOLOTHRIPS 6-MACULATUS (Pergande)

Plate IV, figs. 42-45.

Thrips 6-maculata PÉRGANDE, Trans. St. Louis Acad., V, 1894, p. 542.

Thrips pallida BEACH, Proc. Iowa Acad. Sciences, 1895, III, (1896), pp. 226-227.

Female.—Length, 0.83 mm. (0.72 to 0.97 mm.); width of mesothorax, 0.21 mm. (0.18 to 0.25 mm.). General color clear pale yellow.

Head about three-fourths as long as wide, frequently considerably retracted within prothorax, even to the eyes sometimes; cheeks straight and parallel; front margin rounded; vertex elevated between the eyes. Eyes large, protruding; posterior ocelli nearly contiguous with margins of eyes; one very long, backwardly curved spine stands in front of each posterior ocellus, and two pairs of curved spines stand upon the margin in front. Maxillary palpi slender, three segmented; labial palpi very long and slender. Antennæ rather short and compact; inserted below front margin; approximate at base, relative lengths of segments:

1	2	3	4	5	6	7	8
4.2	7	7.4	6.7	6.1	9	2.5	3.5

Segment one cylindrical, about two-thirds as thick as two, which is more rounded; seven and eight rather thick. Color of one and two nearly white, the remainder almost uniformly dusky gray; spines on segments two to five long and prominent as are the sense cones; the sense cone on the inner side of six arises below the middle of the segment and reaches beyond the end of the seventh.

Prothorax slightly longer than the head, but only about three-fourths as long as wide, broadened somewhat posteriorly and rounded at hind angles, sides curving gently inward anteriorly; spines extremely long and slender, arranged as follows: One at each anterior angle, one half

way between these and the median line, one at middle of each side, two at each hind angle, and one between this pair and middle of hind margin. Mesothorax about one and one-third times as wide as the prothorax, with one slender spine at middle of each side. Wings long, reaching nearly to tip of abdomen, at middle about one-seventeenth as broad as long, pointed at tips. Fore wing with two longitudinal veins and a very heavy ring vein; hind longitudinal vein branches from the fore vein at about one-third the length of the wing. Spines upon costal and both longitudinal veins very long and stout, fully equaling those upon the anal segments; costal vein bears from fifteen to twenty, fore vein from nine to eleven, hind vein five or six (the third and fourth spines, sometimes the second also, which I have counted as standing upon the fore vein, stand at the same angle to the wing as do those upon the hind vein and really belong thereto, though the veins have united); the front fringe of the fore wings is extremely sparse, short and weak, and does not extend to the tip; hind fringes also unusually short. Fore wings are characterized by three light brownish spots on each—one at base of wing, one immediately beyond separation of longitudinal veins, and the third halfway from the second to the tip of the wing (the third is a band extending clear across the wing). Legs concolorous with body, sparsely set with slender spines.

Abdomen cylindrical-ovate, pointed at extremity, surface smooth; only one spine of any prominence at posterior side angles of segments two to eight; spines upon segments nine and ten not as strong as those upon the wings; color nearly uniformly pale yellow without prominent markings.

Redescribed from ten specimens.

Mal.—Male smaller than female, but otherwise agreeing very closely with the foregoing description. Abdomen bluntly conical at tip; tenth segment partially retracted within ninth, which is cut out in last half above the tenth; spines borne on top and sides of nine are shorter and weaker than those on wings.

Described from one specimen.

Food plants.—"Found on many plants infested with red spider, on which it has repeatedly been observed to feed."—Pergande. "Feeding on mites in fold of cottonwood leaf."—Bruner. Taken on bean, blackberry, elm, and hop.—Beach.

Habitat.—Missouri?; Ames, Iowa; Barraboo, Wisconsin; Lincoln, Nebraska.

Thrips pallida Beach is positively identical with this species, as has been learned from an examination of her types.

Genus RAPHIDOTHIRIPS Uzel.

Ocelli present. Antennæ eight segmented; the fifth segment short and cut off abruptly at the end so that it joins the base of the sixth by an unusually broad surface; style very slender, composed of two equally

long segments, which are together as long as are the fifth and sixth. Maxillary palpi three segmented. Prothorax a little longer than the head and somewhat broader at the hind than at the fore edge; no long spine at the front angles, but two at each hind angle. Legs unarmed. Wings usually reduced, but when present they are of medium length, and have two longitudinal veins which are set with small spines.

I find here only the new species *fuscipennis*.

RHAPHIDOTHrips FUSCIPENNIS, new species.

Plate V, figs. 46-48.

Female.—Length 1.32 mm. (1.20 to 1.66 mm.); width of mesothorax 0.24 mm. (0.22 to 0.27 mm.). General color nearly uniform chestnut brown.

Head as long as wide, but little shorter than prothorax, into which it is retracted a little; anterior margin slightly elevated and rounded; constricted a bit close behind the eyes; cheeks nearly straight behind the constriction and diverging slightly posteriorly so the head is widest at hind edge; back of head finely striated. Eyes quite large, rounded, protruding; margins light; ocelli present, larger than facets of eye, light colored with dark crescentic margins, well separated, but posterior ones not contiguous with margins around eyes; ocellar spines very long and conspicuous; post-ocular spines quite large. Mouth cone extending back to anterior edge of mesosternum, slender, so that head from below appears considerably elongated; labial palpi small; maxillary palpi quite long, slender, and three segmented. Antennæ twice as long as head; relative lengths of segments:

$\frac{1}{5.8}$	$\frac{2}{9}$	$\frac{3}{11}$	$\frac{4}{10.3}$	$\frac{5}{6.25}$	$\frac{6}{10.5}$	$\frac{7}{8.2}$	$\frac{8}{8.25}$
-----------------	---------------	----------------	------------------	------------------	------------------	-----------------	------------------

First segment shortest, cylindrical; second cup-shaped; third pedicellate; third, fourth, and sixth are approximately equal in thickness; third and fourth elliptical; fifth constricted at base and increasing in size to apex, where it is cut off abruptly and unites by its entire width to the equally broad base of sixth, which tapers gradually from one-third its length to its apex, where it is but slightly wider than seventh; seventh and eighth slender, cylindrical. Color: First and second uniformly slightly lighter brown than head; third and fourth pale yellow with slight brownish tinge; fifth shading from color of fourth to a little lighter than sixth; sixth, seventh, and eighth gray-brown; spines long and fairly conspicuous.

Prothorax slightly wider than long, widest at posterior angles; sides but slightly arched; no prominent spines at anterior angles; two stout spines stand close together at each posterior angle; surface finely striated and set with a few scattered small spines; bases of spines light

yellowish; pronotum frequently extending considerably over front edge of mesonotal plate. Mesothorax about one and one-third times as wide as the prothorax and considerably wider than metathorax, except at its anterior edge; anterior angles of mesothorax very acute; no conspicuously large spines upon pterothorax. Wings sometimes reduced; when present, long and about one-thirteenth as broad in middle as long; fore wings shaded with gray, pale brownish along veins, clear at base; second longitudinal vein arises at about two-fifths the length of the wing, its origin indistinct. Spines upon all veins quite long and slender, but not thickly set or very conspicuous; costa bears seventeen to nineteen, fore vein eight or nine, hind vein eight or nine. Wing pads, when present, not overreaching the pterothorax. Legs moderately strong, but not thickened; femora and tibiae dark brown like body; inside of fore tibiae, extreme tips of the others and all tarsi pale gray or yellow; legs scatteringly set with fine spines, apex of hind tibiae alone bearing a pair of stouter spines.

Abdomen very long—almost twice as long as head and thorax together—and three times as long as broad, nearly cylindrical, tapering abruptly from anterior edge of eighth segment to the apex; segments overlapping more or less when abdomen contains no eggs; color uniform dark brown without conspicuous markings or spines except those upon two terminal segments, which are quite long and slender.

Described from six females, five of them long-winged.

Cotype.—Cat. No. 6329, U.S.N.M.

Male unknown.

This species agrees very closely in most respects with *R. longistylusa* Uzel, but differs in the following points: Head as wide as long; second antennal segment somewhat shorter than third, fourth, and sixth; fifth segment lighter colored at tip than sixth. Body length, average (exclusive of egg-filled females), 1.25 mm.

Food plant.—Grass.

Habitat.—Massachusetts.

Life history unknown.

Genus ANAPHOTHRIPS Uzel.

Ocelli present. Antennae eight segmented (apparently nine in *A. striatus*). Maxillary palpi three segmented. Prothorax about as long as head. Legs unarmed. Wings usually present (usually absent in the fall generations of *striatus*), with two longitudinal veins; spines upon veins small and inconspicuous. No stout spines at angles of prothorax; all spines on body short except the anal spines, which are short and slender (in *striatus* they are short and stout).

Males have usually two pairs of very short, stout spines upon the ninth abdominal segment above, of which the anterior pair is stronger than the posterior.

Species of this genus have no power of springing.
In this genus I find only the species *striatus*.

ANAPHOTHIRIPS STRIATUS (Osborn).

GRASS THRIPS.

Plate V, figs. 49-51.

Limothrips poaphagus COMSTOCK, Syllabus of Course of Lectures at Cornell and Peoria, 1875, p. 120.

Limothrips poaphagus LINTNER, Rept. N. Y. Agr. Soc., 1881-82.

Thrips striata OSBORN, Can. Ent., XV, 1883, p. 155.

Limothrips poaphagus FERNALD, Grasses of Maine, 1885, p. 42.

— N. E. Farmer, June 19, 1886.

— LINTNER, 3d Rept. Ins. N. Y., 1887, pp. 96-98.

Limothrips poaphagus COMSTOCK, Introd. to Ent., 1888, p. 127.

Thrips striatus PACKARD, Ent. for Beginners, 1888, p. 73.

— FLETCHER, Ent. Amer., IV, 1888, p. 152.

— HOWARD, Ent. Amer., IV, 1888, p. 152.

Limothrips poaphagus OSBORN, Ins. Life, I, 1888, p. 140.

Thrips striatus PACKARD, Stand. Nat. Hist., 2d ed., II, Append., 1888.

— FLETCHER, 19th Rept. Ent. Soc. Ont., 1888, p. 11.

— FLETCHER, Ann. Rept. Exp. Farms, 1888, pp. 59-62.

Limothrips poaphagus LINTNER, Rept. N. Y. Agr. Soc., 1888.

Phloeothrips poaphagus FLETCHER, 20th Rept. Ent. Soc. Ont., 1889, pp. 2, 22.

— BRODIE, 20th Rept. Ent. Soc. Ont., 1889, p. 8.

Limothrips poaphagus LINTNER, 5th Rept. N. Y. St. Ent., 1889, pp. 153, 304.

— OSBORN, Can. Ent., XXIII, 1891, pp. 93, 96.

— FLETCHER, Ins. Life, V, 1892, p. 124.

— FORBES, Ins. Life, V, 1892, p. 127.

— FLETCHER, Ann. Rept. Exp. Farms, 1892, p. 3.

Limothrips poaphagus COMSTOCK, Man. for Study of Ins., 1895, p. 120.

Limothrips poaphagus UZEL, Mon. d. Ord. Thysanopt., 1895, pp. 279, 435, 446, 448.

Thrips striata UZEL, Mon. d. Ord. Thysanopt., 1895, p. 220.

— HOPKINS-RUMSEY, Bull. 44, W. Va. Agr. Exp. Sta., 1896, pp. 270, 271.

— SMITH, Economic Ent., 1896, p. 102.

— PUTNAM, N. E. Farmer, July 2, 1898.

Anaphothrips striata HINDS, 37th Ann. Rept. Mass. Agr. College, 1900, pp. 81-105, 4 pls., 33 figs.

Anaphothrips striata FERNALD and HINDS, Bull. 67, Mass. Agr. Exp. Sta., 1900, pp. 3-9, pl. 1, figs. 1-6.

Female.—Length 1.3 mm. (1 to 1.6 mm.); width of mesothorax 0.25 mm. (0.23 to 0.26 mm.). General color yellow, with more or less dusky or brownish shading upon some parts.

Head very slightly wider than long, rounded in front; cheeks straight and parallel; surface back of eyes faintly striated; head yellow with brown posterior border, without long spines. Eyes small, rounded, black or very deep purplish red; ocelli subapproximate, yellow, with orange-red margins. Mouth cone moderately sharp, and very prominently tipped with black; maxillary palpi three segmented. Antennæ approximate, about twice as long as head, eight segmented, though

apparently nine segmented, owing to the division of the sixth segment by an oblique suture at about three-fourths its length. Relative lengths of segments:

1	2	3	4	5	6	7	8
5	8.5	11	10	10	9.5+3.5	2.25	3.25

Segments one and two rounded; three to six fusiform. One is pale, almost white; two light brown; three lighter than two; three to six shading gradually to dark brown, almost black; spines pale and not conspicuous.

Prothorax but slightly longer and a little wider than the head; sides rounded slightly and without prominent spines. Mesothorax much wider than prothorax; fore angles obtusely rounded. Metathorax quite smoothly joined with mesothorax and tapering gradually to base of abdomen. Wings usually present in summer generations, reduced to mere pads in hibernating females; when present, approximately as long as abdomen, about one-thirteenth as broad as long and tapering gradually; two longitudinal veins in fore wing extending from base to tip; veins quite prominent, being darker than rest of wing. All veins bear a few very small, rather indistinct spines; fringe on fore edge well developed, being nearly half as long as posterior fringe. Fore wings shaded with yellowish gray; hind wings nearly white. Legs of medium length and size; stout spines only on inner side and at tip of hind tibiae; legs pale yellow shaded with light gray or brown above on femora and tibiae, and with prominent dark brown spot at tip of tarsi within. Pterothorax darker yellow than rest of body, with row of irregular dusky spots on each side close to middle, curving outwardly at both ends.

Abdomen quite long, cylindrical, widening somewhat at first two segments and tapering from eight to tip; eight to ten sharply conical. Spines on nine and ten short and weak, but dark-colored and quite conspicuous; other spines on abdomen small, pale, and indistinct. Abdomen pale yellow; segments one to seven slightly dusky on top, segment ten shading to dark brown at tip.

Redescribed from six long-winged and four short-winged females. Male unknown.

Food plants.—*Poa pratensis* and *Phleum pratense*.

I have also found genuine "silver top" upon the following list of grasses at Amherst, Massachusetts, but I can not positively connect this species with all the injury: *Poa serotina*, *P. nemoralis*, *P. compressa*, *P. arachnifera*, *P. fletcheri*, *P. aquatica*, *P. trivialis*, *P. ossia*, *Agrostis alba*, *A. canina*, *A. stolonifera*, *A. vulgaris*, *Festuca olcottii*, *F. heterophylla*, *F. elatior*, *F. ovina*, *F. duriuscula*, *F. rubra*, *Panicum erio-galli*, *P. sanguinale*, *Elymus striatus*, *E. virginicus*, *Bromus inermis*, *B. inermis*, *Avona flavescens-vera*, *Agropyrum caninum*, *Arrhenatherum elaeagnifolium*, *Lolium perenne*.

Habitat.—Illinois, Iowa, Maine, Massachusetts, New York, Ohio, Ontario.

I have sought in vain for the males of this species, for although I have mounted over a thousand specimens, and have bred many more in bottles in the laboratory, and have taken and examined large numbers of them in the field, I have never seen any that I even suspected were males. A series of experiments begun in the laboratory in July and continued into December showed that no males are developed in the autumn generations. Experiments were begun the following season by obtaining hibernating females before the weather was warm enough for them to move out of doors and confining them in bottles in the laboratory. These became active and deposited eggs, from which succeeding generations developed without the appearance of any males. I conclude, therefore, that this species is parthenogenetic, and reproduces without the intervention of males, at least for a series of generations, in this locality.

The following descriptions are of the early stages:

Eggs.—The eggs are reniform, and vary in length from 0.265 mm. to 0.33 mm. and in width from 0.085 mm. to 0.145 mm. The average dimensions taken from twenty-five eggs are: Length, 0.288 mm.; width, 0.11 mm. The color is a translucent white. By transmitted light the eggs are seen to be filled with a mass of yolk globules which vary considerably in size.

Larva.—As the larva emerges from the egg it is very soft, shiny, and nearly white. The eyes are purplish red in color; the appendages are folded closely against the ventral side of the body. The length soon after emergence is about 0.3 mm. and the width is about 0.1 mm. Body tapers from eighth segment to tip; head is nearly as wide as the thorax. Antennæ are comparatively large, approximate at base, and composed of seven segments, of which the last four are closely joined and appear almost like a single conical segment; fourth segment is larger than any other, and distinctly ringed with whorls of minute hairs; the second and third are indistinctly ringed; basal segment bears one small spine on inner side; two has four spines which are directed forward and one very long spine which is directed backward toward the head; the third bears five short spines, and the terminal part of the fourth and each of the following segments a number of spines, which are quite long and stout. Legs are stout; tarsi one segmented and terminated by two claws. The bladder-like expansion is present. Abdomen much compressed longitudinally and, except the tenth segment, marked with six longitudinal rows of setæ, three pairs to each segment. The four dorsal rows also extend forward along the thorax and head; tenth segment bears six very long setæ—two dorsal, two lateral, and two ventral.

The full-grown larva is fusiform, about 1.2 mm. in length and about 0.3 mm. in breadth, while the width of head is about 0.1 mm. Antennæ

seven segmented, somewhat separated at their base and rather thick for their length; color darker than that of the body, often nearly black; segmentation beyond fourth segment more distinct than in immature larva; first four segments subequal in thickness, and third and fourth nearly equal in length, and each as long as the first and second segments together; last three segments much smaller; fifth shortest. Spines arranged much as in younger stage; third segment distinctly ringed and without setæ. Each segment, except last two, bears short spines which are slightly thickened at their extremities, and arranged as in the young larva; spines on last two segments long and acute. Integument of body roughened by transverse rows of clearly defined ridges. Body marked by dorsal and lateral longitudinal stripes of yellow which are most distinct upon thorax; dorsal stripe widest.

Pupa.—Its general form resembles that of the larva; color of legs, wing pads, and antennæ clear white; thorax and abdomen very light yellow; eyes bright red. When the pupal stage is first entered the antennæ are apparently three or four segmented, much shortened, and directed forward as in the larva; but after a few hours they are laid back upon the head and thorax. Wing sheaths short and developed outside of the body; legs thick and clumsy. Upon dorsal side of ninth segment, near posterior margin, are four prominent, stout, recurved, hook-like processes; abdominal setæ slender and acute. Wing sheaths finally extend to the sixth segment and fore pair bear a few small spines.

Life history.—About 98 per cent of the adults which hibernate are of the short-winged form, while from 90 to 95 per cent of the first generation in the spring develop long wings, and this form predominates until late summer, when the proportion declines, and in October only a small number of winged adults can be found. The females continue to deposit eggs and the young larvæ develop and may be taken from the grass upon warm fall days till snow covers the ground; but so far as I can find, only the adults survive the winter. Hibernating females do not appear to suffer from exposure to a temperature of -21° F., and they may be brought in at any time during the winter by pulling a few handfuls of grass from infested fields and bringing it into a warm room, where the little animals will very soon become lively and begin to crawl. Accidentally it was found that they could survive for several days though completely submerged in a weak solution of potassium hydrate, and they have been found to revive after being frozen solid in a 2 per cent solution of the same; but so far as my experiments went, freezing in pure water killed them. The females become active very early in the spring and the development of eggs begins. As many as eight apparently fully developed eggs have been seen at one time in the body of one of these hibernated females. Ovipos-

sition soon begins, and lasts for from four to six weeks in many cases. They seem to oviposit as readily at night as in daylight. The deposition of an egg requires about one and one-half minutes. The eggs may be readily seen in the leaf by holding it before a light, when they appear as small, lighter spots; they may be easily separated from the leaf by stripping off the epidermis. The length of the egg stage varies from ten to fifteen days for the first generation to from four to seven days during the heat of summer.

The length of the larval stage varies from two weeks in early spring to about four days in midsummer. The mature larvæ select secluded places in which to transform and are hard to find in the field, but it appears that they usually go down to the basal leaves near the root or into the sheaths higher up the stem. The pupal stage is longer for the long-winged females than for the short, in the former requiring four or five days in early spring, whereas the short-winged form requires only from two to three days at the same season. As the weather becomes warmer they transform more rapidly. The appearance of a number of winged adults early in May marks the maturity of the first generation, but as the length of the period of oviposition exceeds the length of time required for the early stages, there is no distinct line between the generations out of doors after this time. The length of the life cycle is from about twelve to thirty days.

Common name.—Since Professor Comstock's first mention of the injury done by this species of Thrips to June grass and timothy, several economic entomologists have referred to the most conspicuous effects of its work, the dead tops of these grasses, as "Silver top" or "White top." Many have questioned the agency of Thrips in producing this injury and have ascribed it to some other suctorial insect, but the majority of writers are now inclined to credit Thrips with a large part, if not all, of this damage. As they had no means of identifying the little pest, they have usually referred to it as the "Grass Thrips." This name has been very generally used for this species and for no other, so far as we can learn. It therefore appears to be the generally accepted common name.

Economic notes.—Extensive injuries to grass have been reported from the New England States, New York, southern Canada, Ohio, northern Illinois, and Iowa. Without doubt the insect causing this damage infests a larger territory than this, for it is so small that it easily escapes observation, and the damage done by it is often attributed to other agencies. In southern Maine, Professor Fernald reported (253) that by haying time one-fourth of the June grass (*Poa pratensis*) in the fields was dead and worthless. In 1887 it produced great injury around Emmet, Ohio, where 30 per cent of the grass was killed (272). In 1888 and 1889 widespread injury was reported from New York (291) and Ontario (322), where it appeared to work most

upon lawns and meadows. In Massachusetts, especially in dry seasons, its injuries are severe, it having been stated by Prof. W. P. Brooks that this tiny foe does more damage to grasses here than any other single insect.

Genus APTINOTHRIPS Haliday.

Body slender, almost naked. Head longer than wide, extending forward in a blunt projection between the eyes. Eyes small; ocelli wanting. Antennæ eight segmented (six segmented in *A. rufus* var. *connaticornis*). Maxillary palpi three segmented. Prothorax shorter than the head and somewhat broadened posteriorly, without long spines at angles. Legs short; femora plainly thickened; tibiæ very slender at the base, the remainder unusually broad; tarsi equally broad. Wings entirely absent. Hairs at end of abdomen short and very slender.

Males with two spines in middle of ninth segment above.

Species of this genus move slowly and have no power of springing.

I have found only the species *rufus* and its variety, *connaticornis*, belonging to this genus.

APTINOTHRIPS RUFUS (Gmelin).

Plate V, figs. 52-54.

"Der rothe Blasenfuss" v. GLEICHEN, das Neueste aus dem Reiche d. Pflanzen, 1764, pl. xvi, figs. 6 and 7.

Thrips rufa GMELIN, Caroli a Linné Systema Nat., 1788, p. 2224.

Thrips rufa NICHOLSON, Journ. Nat. Phil., 179-, pl. viii, fig. 1.

Thrips (Aptinothrips) rufa HALIDAY, Entom. Mag., 1836, p. 445.

Thrips (Aptinothrips) rufa HALIDAY-WALKER, Homopt. Ins. of Brit. Mus., 1852, p. 1103, pl. v, figs. 5-11.

Aptinothrips rufa LENDEMAN, Bull. Soc. Imp. d. Natur. d. Moscow, 1886, pp. 319-320, fig. 11.

Aptinothrips stylifera TRYBOM, Entom. Tidskrift, Årg. 15, Häft. 1-2, 1894, pp. 41-58.

Aptinothrips rufa UZEL, Mon. der Ord. Thysanoptera, 1895, pp. 152-154, pl. II, fig. 17; pl. VI, figs 78, 79.

Aptinothrips rufa TRYBOM, Ofv. Ak. Forh., 1896, p. 613.

Aptinothrips rufa REUTER, Über die Weissährigkeit der Wiesengräser in Finland, 1900. Scattered references, especially pp. 92-120.

Aptinothrips rufa TUMPPEL, Die Geradflügler Mitteleuropas, 1901, p. 290.

Female.—Length 1.22 mm. (1.06 to 1.30 mm.); width of mesothorax about 0.18 mm. (0.16 to 0.20 mm.). General color, entire body and legs clear, pale yellow; outer part of antennæ, mouth parts, and tip of abdomen shaded with brown. Body slender and smoothly fusiform.

Head considerably longer than broad, rounded in front; cheeks straight and parallel. Eyes small, black, oval, composed of few facets, situated at anterior angles, protruding very slightly; ocelli always absent. Mouth cone moderately long, not sharply pointed, tipped with brown-black; maxillary palpi three segmented. Antennæ

only one and three-sevenths times as long as the head, approximate at base, composed in the typical form of eight segments of following relative lengths:

$\frac{1}{5.5}$	$\frac{2}{7.7}$	$\frac{3}{7.5}$	$\frac{4}{6.1}$	$\frac{5}{6.1}$	$\frac{6}{11}$	$\frac{7}{3}$	$\frac{8}{3.3}$
-----------------	-----------------	-----------------	-----------------	-----------------	----------------	---------------	-----------------

Segment one is broadly rounded; two has an unusually constricted basal stalk, though it is broader than that of three; three to five bear each one quite slender sense cone on outer angle, and six has one on inner side beyond the middle; spines and sense cones upon all segments pale and inconspicuous. Antennae concolorous with head at base, but shading outwardly gradually to brown-black at tip.

Prothorax slightly shorter than head and a little broader than long; smooth and without spines. Pterothorax a little broader than prothorax, without spines or traces of wings. Legs short and thick, all nearly equal in length, concolorous with body; tarsi tipped with brown within.

Abdomen unusually long and slender, nearly three and one-half times as long as its greatest diameter, about twice as wide as head, nearly cylindrical to eighth segment, then tapering to a point at tip. No spines upon abdomen except around segments nine and ten; these are quite short and slender and stand out nearly perpendicularly to the surface upon which they are borne. Extreme tip of ten shaded very dark brown.

Redescribed from three specimens.

Males unknown to me. According to Haliday, they are clear yellow, and the saffron-yellow spermaries show through the abdominal walls. The ninth abdominal segment bears two spines in the middle above, not far from the hind edge.

Var. connaticornis Uzel.—This variety agrees very closely with the typical form except that the antennae have only six segments; the relative lengths of segments are as follows:

$\frac{1}{5}$	$\frac{2}{7}$	$\frac{3}{7}$	$\frac{4}{6.5}$	$\frac{5}{6}$	$\frac{6}{16.3}$
---------------	---------------	---------------	-----------------	---------------	------------------

The sixth, seventh, and eighth segments are grown together into one compact sixth segment of an elongated conical form. The abdomen may be a little shorter in proportion and broader.

No males have been taken.

This species appears to be surely *Apt. rufus* Gmelin, but it is larger and differs in some other respects.

Food plants.—Various grasses and in turf.

Habitat.—England (Haliday), Russia (Lindeman), Sweden (Trybom), Bohemia, Germany, Helgoland (Uzel), Finland (Reuter), United States: Amherst, Massachusetts.

Life history unknown.

Genus HELIOTHRIPS Haliday.

Body, especially the head and prothorax, with a deeply reticulated structure. Head broader than long, uneven, somewhat broadened behind, and with a sharp hump between the eyes in front. Cheeks not arched, contracted into saddle-shape in the middle. Eyes prominent but not protruding. Ocelli present. Antennæ eight segmented; second segment of style very much longer than the first and provided with a short, slender hair at the tip. Maxillary palpi sometimes two, sometimes three segmented. Prothorax shorter than the head, without long spines at angles. Legs unarmed. Wings present, not reticulated. Fore wing broad at base, with two longitudinal veins, though the fore vein runs very near to and sometimes fuses with the costa; veins set with slender spines; fore fringe, in some species, very weak and sparse, and when this is the case the costal spines are very strongly developed. Anal spines weak and light.

The characters of this genus have been extended to include these species

SYNOPSIS OF SPECIES.

1	{ All tibiae yellow	2
	{ Middle and hind tibiae brown	3
2	{ Antennæ nearly three times as long as head	<i>femoralis</i> (p. 172)
	{ Antennæ only about twice as long as head	<i>haemorrhoidalis</i> (p. 168)
3	{ Antennæ two and one-half times as long as head; segments three and four nodi-	
	liform. Maxillary palpi three segmented	<i>fasciatus</i> (p. 174)
	{ Antennæ twice as long as head; segments three and four fusiform. Maxillary	
	palpi two segmented	<i>fasciapennis</i> (p. 171)

HELIOTHRIPS HAEMORRHOIDALIS (Bouché).

Thrips haemorrhoidalis BOUCHÉ, Schäd. Garten-Insecten, 1833, p. 42.

Heliothrips adonidum HALIDAY, Entom. Mag., III, 1836, p. 443.

Heliothrips haemorrhoidalis BURMEISTER, Handb. d. Entomologie, II, 1838, p. 412.

Heliothrips haemorrhoidalis BURMEISTER, Genera Insectorum, colored illustration, 1838.

Heliothrips haemorrhoidalis AMYOT and SERVILLE, Ins. Hemipt., 1843, p. 641.

Heliothrips haemorrhoidalis HALIDAY, Walker, Homopt. Ins. Brit. Mus., 1852, p. 1002, pl. vi, fig. 13.

Heliothrips haemorrhoidalis HEEGER, Fünfte Fortsetzung. Sitzungsab. Kais. akad. Wiss., Wien, IX, 1852, p. 473, pl. xvii; separate, Wien, Gerold, 1852, VIII, pp. 3-4.

Thrips haemorrhoidalis BREMI, Stett. Ent. Zeit., 1855, pp. 313-315. Reprinted from Abhandl. d. Zurich Gartenbau-Gesell., III, pp. 260-261.

Heliothrips haemorrhoidalis LÖW, Verhandl. d. k. k. zool.-bot. Gesellsch., Wien, XVII, 1867, p. 747.

Heliothrips haemorrhoidalis BOISDUVAL, Ent. Hortie., 1867, pp. 233-235, fig. 32.

Heliothrips haemorrhoidalis PACKARD, 17th Ann. Rept. Mass. Bd. Agr., 1870, p. 263, pl. i, fig. 2; Injurious Ins. new and little known, p. 31.

Thrips adonidum COOK, 3d Ann. Rept. Pom. Soc. Mich., 1873-74, 1874, p. 501.

Heliothrips haemorrhoidalis PACKARD, Half Hours with Ins., 1881, pp. 118-119, fig. 36.

- Heliothrips haemorrhoidalis* PERGAUDE, Psyche, III, 1882, p. 381.
Heliothrips LEFEVRE, Ent., XV, 1882, p. 240.
Thrips haemorrhoidalis FRIČ, Přírodopis živočišstva, 1882, p. 113.
Heliothrips haemorrhoidalis LINTNER, 2d Rept. Ins. N. Y., 1885, pp. 29, 31, 38, 56.
Heliothrips haemorrhoidalis ———, Bull. Soc. Ent. Belgique, XXIX, 1885, p. LXX.
Heliothrips adonidum CAMERON, Trans. Nat. Hist. Soc. Glasgow (new ser.), I, 1886, p. 301.
Heliothrips haemorrhoidalis TARGIONI-TOZZETTI, Cronaca entomologica dell' anno, 1887, (1888), p. 5 (7).
Heliothrips haemorrhoidalis JORDAN, Zeit. f. Wissens. Zool., XLVII, 1888, pp. 541–620, pls. XXXVI–XXXVIII.
Heliothrips haemorrhoidalis REUTER, Meddal. af. Soc. Fauna Flora Fenn., XVII, 1891, pp. 164–165.
Heliothrips haemorrhoidalis UZEL, Mon. d. Ord. Thysanopt., 1895, pp. 168–170, pl. VI, figs. 90–92.
Thrips (Heliothrips) haemorrhoidalis FRANK, Die tierparasitären Krankheiten der Pflanzen, 1896, p. 134.
Heliothrips haemorrhoidalis BUFFA, Riv. Patol. Veget., VII, No. 1–4, pp. 94–108; continued, VII, Nos. 5–8, 1898, pp. 129–135, 136–142.
Heliothrips haemorrhoidalis TÜMPER, Die Geradflügler Mitteleuropas, 1901, p. 290.

Female.—Length 1.23 mm. (1.12 to 1.39 mm.); width of mesothorax 0.30 mm. (0.25 to 0.35 mm.). Color of head and thorax dark brown; abdomen yellowish brown, fading at tip to brownish yellow. Entire body and legs showing reticulating chitinous thickenings, which are heaviest upon the head, thorax, and anterior sides of abdomen. Head one-fourth wider than long, outline very irregular and rough; cheeks slightly concaved, narrowed abruptly near posterior edge into a short neck; anterior margin strongly arcuate; dorsal surface of head bears a few small spines, the bases of which appear like small air bubbles in the angles of reticulations; frons reticulated. Eyes protruding considerably, strongly pustulated; three ocelli situated on sides of an elevation between the eyes, separated considerably from margins of eyes, pale yellowish, very faintly or not at all margined inwardly by crescentic pigmentation. Mouth cone short, blunt, not reticulated; maxillary palpi three segmented, second segment longest; labial palpi short. Antennæ twice as long as head; relative lengths of segments as follows:

1	2	3	4	5	6	7	8
$\frac{1}{5}$	$\frac{2}{10.3}$	$\frac{3}{17.7}$	$\frac{4}{13}$	$\frac{5}{11}$	$\frac{6}{9.7}$	$\frac{7}{4}$	$\frac{8}{15.5}$

Second segment thickest, others very slender, especially peduncle and basal half of three; seventh is nearly cylindrical, narrow, no thicker than bases of four and five; eight is very slender, tapering slightly, and bearing a single very slender bristle at its tip. Color of one and two light brownish yellow; three, four, and five clear pale yellowish; six abruptly brown, yellowish in basal third; seven and eight gray. Spines upon antennal segments pale and inconspicuous, three especially long ones being situated one each upon the outer angles of three and

four and the inner angle of six; segments three to five faintly annulated.

Prothorax transverse, only about three-fourths as long as head, but nearly twice as wide as long, rounded at the angles; sides slightly concaved, bearing a few small spines, of which only the bright bases are usually visible; reticulation heavy, but interrupted across the middle. Mesothorax one and one-fourth times as wide as the prothorax; reticulation upon mesonotum quite heavy, regular upon anterior half, upon posterior half elongated toward a deep incision in the hind margin of the plate, the longitudinal thickening becoming weaker. Metanotum prominent, triangular, strongly reticulated. Wings very slender, not nearly reaching to tip of abdomen, broadened abruptly at base to more than twice their diameter at middle; only one distinct longitudinal vein, and this sends off a short oblique branch to costal vein. Anterior fringe very short and sparse; posterior quite long and heavy; no prominent spines upon veins. Legs rather short and thick; pale yellowish, except coxæ brownish; first and second pairs about equally long; hind pair a little longer; all legs reticulated.

Abdomen elongate-ovate, pointed at tip; dorsum reticulated; segments two to eight with irregular transverse brown line near front edge of each. Spines upon abdomen mostly small and indistinct; most prominent ones situated upon middle of dorsum of segments two to eight, close to median line; these gradually increase in size posteriorly; anal spines short and weak. Color of abdomen varies from brownish yellow to dark brown; last two segments usually much lighter but less variable in color than rest of abdomen, being regularly brownish yellow tipped with dark brown.

Redescribed from eight females.

Male unknown.

In Germany this species is called "Black Fly."

Food plants.—*Aspidium*, azaleas, *Croton*, dahlias, ferns, Liliaceæ, *Pellea hastata*, *Phlox*, pinks, verbenas, vines, etc.

Habitat.—England (Walker, Cameron), Germany (Bouché, Burmeister, Bremi, Jordan, Bohls), Vienna (Heeger, Löw), Finland (Reuter), United States: District of Columbia, Iowa, Massachusetts, Michigan.

Life history unknown.

In his original description Bouché states that he believes the native land of this species is America. In both countries, however, it has been found almost entirely confined to greenhouses and feeding upon greenhouse plants.

It has been very injurious in some places. Packard calls it "one of our greatest pests in hothouses," and Cook records it as "one of the worst pests around Detroit, at Adrian, and in the southern counties" of Michigan.

HELIOTHRIPS FASCIAPENNIS, new species.

Plate VI, figs. 58-61.

Female.—Length 0.92 mm. (0.90 to 0.94 mm.); width of mesothorax 0.22 mm. (0.22 and 0.23 mm.). General color yellowish brown or dark brown. Head, thorax, and legs distinctly but not deeply reticulated.

Head about one and one-third times as wide as long; form rather rectangular; front margin depressed at insertion of antennæ; cheeks nearly straight. Eyes dark, quite large, prominent but hardly protruding, margins lighter; ocelli present, approximate, pale yellow with dark crescentic margins, well removed from eyes. Maxillary palpi small, two segmented. Antennæ eight segmented, twice as long as head; relative lengths of segments:

$$- \frac{1}{4} \quad \frac{2}{8} \quad \frac{3}{11} \quad \frac{4}{10} \quad \frac{5}{9} \quad \frac{6}{5.5} \quad \frac{7}{3.5} \quad \frac{8}{8}$$

Segment one much narrower than two and almost spherical; two is thickest segment and but little longer than thick; three and four fusiform; five clavate; six and seven together of same form as five only inverted; eight very slender and terminated by an equally long hair. Segments one and two, outer half of five, six, seven, and eight brown; three, four, and basal half of five pale yellow. Spines on three, four, and five long, dark, and prominent; color around bases of those on three and four brownish.

Prothorax as long as head and less than twice as wide as long; sides rounded slightly and diverging somewhat posteriorly; without prominent spines at angles; concolorous with head and reticulation of about same depth. Mesothorax somewhat wider than prothorax; anterior edge about straight and angles nearly right angular; membrane yellow; plates brown. Wings long, overreaching the abdomen; fore wing quite slender beyond basal fourth at which point the hind longitudinal vein branches from the fore vein; width in middle about one-fifteenth its length; both veins run close to edges of the wing, the fore one becoming fused with the costa while the hind one remains distinct. Internal veins set with few short spines; costa set with stout spines but without fringe except for slight vestiges along the middle; hind fringe long, dark, and wavy. Wing dark brown crossed with three bands of white as follows: At one-fifth, three-fifths, and four-fifths its length; outer part of scale also white; the brown area at the tip is confined to edge on border around last fifth, the middle here being grayish and in continuation of the last white band. Legs fairly stout but not thickened, weakly reticulated; femora yellowish brown to dark brown; front pair lightest and yellow at tips; fore tibiae yellow shaded with brown around middle; the other tibiae brown, yellow at

tips; all tarsi pale yellow with brown shading at bases of bladders; spines weak and light colored; hind coxæ large, approximate, and about twice as long as wide.

Abdomen elongated ovoid, about twice as long as wide; width of segments gradually increasing up to the fourth, then decreasing gradually to tip; greatest width equal to about twice that of head; dark line across segments one to eight irregular, conspicuous only on the lighter specimen; that on segment one curving forward greatly in middle. Surface of abdomen very faintly reticulated, but this is not visible on darker specimen; spines on last two segments short and fine; color yellowish brown to dark brown, lightest along middle.

Described from two females.

Cotype.—Cat. No. 6330, U.S.N.M

Male unknown.

Food plants.—Taken on grass.

Habitat.—Amherst, Massachusetts.

HELIOTHRIPS FEMORALIS Reuter.

Plate V, figs. 55, 56; Plate VI, fig. 57.

Heliothrips femoralis REUTER, Meddel. af Societas pro Fauna et Flora Fennica, XVII, 1891, p. 166.

Heliothrips ceciliæ PERGANDE, Ins. Life, VII, No. 5, 1895, pp. 390-391.

Heliothrips femoralis UZEL, Mon. d. ord. Thysanoptera, 1895, p. 170.

Heliothrips femoralis BERGROTH, Ann. Soc. Ent. Belgique, XL, 1896, Pt. 2, p. 67.

Female.—Length 1.3 mm. (1.12 to 1.5 mm.); width of mesothorax about one-fourth the body length. General color dark brown to yellowish brown, lighter at extremities. Entire surface of body weakly but plainly reticulated.

Head two-thirds as long as broad, widest in front; anterior margin depressed at insertion of antennæ; vertex carinated; bases of antennæ separated by a prominence as high and nearly as wide as the first antennal segment; two transverse wrinkles near back of head more prominent than the others; behind the anterior one of these two the longitudinal parts of the reticulations become very faint; spines upon head scattering and small. Eyes quite large, protruding anteriorly, coarsely granulated; eyes and margins of ocelli bright, dark red by reflected light; ocelli placed on sides and front of a distinct elevation on top of head between eyes. Head light brown with light yellowish longitudinal stripe on each side between eye and ocelli. Maxillary palpi three segmented, short, small; labial palpi minute. Antennæ eight segmented, slender, nearly three times as long as head; relative lengths of segments as follows:

1	2	3	4	5	6	7	8
5	8.8	16.6	12.2	11	8.6	4.3	10.5

Segment one cylindrical, three-fourths as broad as two, which is

barrel-shaped and annulated; remaining segments narrower than these two and more elongated; three and four fusiform; seven and eight nearly cylindrical; eight very slender; one, two, and three nearly concolorous, light yellow with tinge of gray or brown on one and two; four and five light yellow in basal half, shading to light brown on apical half; six, seven, and eight uniformly chocolate brown; segments two to five annulated; spines slender, light colored.

Prothorax transverse, about one-fifth wider than the head, twice as wide as long and shorter than the head; sides rounded; without conspicuously large spines. Mesothorax about one and two-thirds times as wide as the head; anterior angles prominent; mesonotum with deep incision on posterior margin; metanotum with four spines standing in a square near its center. Wings present, long, about one sixteenth as broad as long; fore wings broadened at base, with two longitudinal veins, the second branching from the first not far from the base of the wing. Spines upon veins of fore wing stout, dark colored, and set at uniform distances; costa bears seventeen to twenty, fore vein fourteen to seventeen, hind vein ten to thirteen, scale three to five besides pair at its tip; spines on basal fourth of wing are light colored, smaller and much less conspicuous; anterior fringe on both wings fairly long and stout; posterior fringe long, slender, and dark colored. Wings grayish brown to dark gray, lighter between the longitudinal veins; three nearly white cross bands; one across base before branching of veins, another at three-fourths the length of wing and the third across the tip. Legs: All tibiae, tarsi, and fore femora yellow; middle and hind femora dark brown, yellow only at ends; spines upon legs small and inconspicuous except ten to twelve on inner side of hind tibiae.

Abdomen broadly ovoid, conical at tip, twice as wide as head; ovipositor long and slender; tenth segment split open above; segments two to eight with dark cross line near anterior edge. Two or three spines on sides of each segment from two to eight, not conspicuous; anal spines weak. Color of abdomen yellowish brown to dark brown; last two segments much more yellow, but shading to brown at posterior edges.

This species has the power of springing.

No males found.

Food plants.—*Amarillis* sp., *Aralia*, *Arum*, *Cestrum nocturnum*, *Chrysanthemum*, *Crinum*, cucumber, *Dracaena* spp., *Eucharis grandiflora*, *Ficus elastica*, *F. grandiflora*, *Gardenia*, *Gossypium*, *Hydrangea*, *Mina lobata*, moonflower, *Pandanus*, *Phoenix*, *Richardia aethiopica*, tomato, *Vitis*.

Habitat.—Helsingfors, Finland (Reuter), United States: District of Columbia; Amherst, Massachusetts.

Life history unknown.

HELIOTHRIPS FASCIATUS Pergande.

Heliothrips fasciata PERGÁNDE, Ins. Life, VII, No. 5, 1895, pp. 391-392.

Female.—Length 1 mm.; width of mesothorax (0.29) mm. Body faintly reticulated. General color dark brown.

Head about two-thirds as long as wide; cheeks straight; anterior margin depressed at insertion of antennæ; color uniformly brown. Eyes small, black, not protruding; ocelli pale yellowish margined with reddish. Mouth cone moderately long; maxillary palpi slender, three segmented. Antennæ two and one-half times as long as head, eight segmented; bases separated by low elevation; relative lengths of segments:

1	2	3	4	5	6	7	8
$\frac{1}{4.5}$	$\frac{2}{9}$	$\frac{3}{13}$	$\frac{4}{11}$	$\frac{5}{9.25}$	$\frac{6}{6.5}$	$\frac{7}{3.5}$	$\frac{8}{7.5}$

Segment one rounded, wider than long; two is broadest, constricted abruptly at base, broad at outer end; three and four are of similar shape: modioliform (uniformly constricted at each end with median enlargement regular); outer end of five is quite broadly cut off; six is abruptly constricted at base, outer half tapering gradually; seven nearly cylindrical; eight tapers gradually and bears one very long, slender hair at tip nearly as long as segment itself. One and two uniformly brown, concolorous with head; three and four with light brownish ring around middle of enlargements; remainder pale yellowish, as is also basal half of five; rest of antenna brown; spines around middle of segments three and four and near end of five are long, dark, and conspicuous.

Prothorax fully twice as wide as long, slightly wider at posterior edge than at anterior, without conspicuous spines, colored like head. Mesothorax widest at posterior edge; sides curving gradually inward to anterior edge. Metathorax as wide at front edge as mesothorax is at hind edge, and its sides curve gradually to base of abdomen, so pterothorax appears smoothly rounded. Wings present, extending to tip of abdomen, slender except where broadened at base; two longitudinal veins, the second branching from the first near the broadened base; the fore vein then inclines toward the costal and runs contiguous with it to tip of wing; the hind vein runs close to hind edge, but is distinct. Costal spines twenty in number, very large and stout, much longer than the very weak fringe; fore vein bears four stout spines at basal third and two not far from tip; hind vein bears five moderately long spines; posterior fringes dark, heavy, and wavy. Wings grayish brown, darkest over veins; fore wings at base and a rather broad band at three-fourths their length transparently white, darkest brown around the outer shaded portion. Legs of medium length; femora and tibiae dark brown except around outer ends of femora, and both

extremities of tibiae pale yellowish; tarsi also yellowish, brownish around tips; legs bearing quite a number of inconspicuous spines; hind tibiae alone bearing stout spines at their tips.

Abdomen broadly ovate, pointed at tip, wider than thorax. Color dark brown, somewhat lighter on last two segments. Anal spines weak, especially on last two segments; the few spines on sides of segments two to eight are inconspicuous.

Redescribed from one specimen at U. S. Department of Agriculture, Division of Entomology.

Male not known.

Food plants.—Orange leaf infested with *Aspidiotus aurantii*. (Probably not feeding on scale.)

Habitat.—Yuba County, California.

Life history unknown.

Genus PARTHENOTHRIPS Uzel.

The body, principally the head and prothorax, with deeply reticulated structure. Head broader than long, with a hump in front between the eyes; cheeks swollen, constricted into a short neck at hind edge. Eyes protruding; ocelli present. Antennae seven segmented, very slender except the first two segments; style one segmented, hair-like, as long as the sixth segment and bearing a slender hair of equal length at the tip. Upon the third to the sixth segments, separated from each other, there are always two sense cones. Maxillary palpi two segmented, the second segment being distinctly longer than the first. Prothorax plainly shorter than the head, uneven, broadened posteriorly, with one long spine upon each hind angle. Legs unarmed. Wings very broad and long, so that they reach beyond the end of the abdomen. The fore wings have the form of a "cake-knife;" their surface is reticulated and there appears to be only one longitudinal vein and a very strongly developed ring vein. The vein arising from the base of the wing bends forward at the first fourth of the length of the wing and unites with the unusually strong ring vein from that point, while the hind vein, branching from the main vein at this point, bends toward the hind edge of the wing and runs parallel to it, but remains distinct. The fore fringe has disappeared and its place is taken by the stout costal spines. The hind vein is set with stout spines at regular intervals. Beyond the first fourth the wing is somewhat narrower than at the basal fourth. The front edge is nearly straight and the hind edge bending forward unites with it to form a sharp point. The last two abdominal segments are distinctly narrowed in the females. The spines at the end of the abdomen are weak and light. The species belonging here have the power of springing.

I have found only the species *dracaenæ* of this genus.

PARTHENOTHRIPS DRACÆNÆ (Heeger).

Plate VI, figs. 62-65.

Heliothrips dracænæ HEEGER, Sitzungsab. d. math.-naturw. Classed. kais. Akad. d. Wissensch., Wien, XIV, December, 1854., p. 365. Separata. Boitrag zur Naturgeschichte d. Insecten Oesterreichs, pp. 3-7.

Thrips dracænæ REGEL, Bull. phys.-mathem. Acad. Sciences, St Petersburg, XVI, 1858, pp. 333-336; Melang biolog., II, 6, pp. 628-633

Heliothrips dracænæ v. FRAUENFELD, Verhandl. d. k. k. zool.-bot. Gesellsch., XVII, Zool. Miscellen, XIII, 1867, pp. 793-801.

Heliothrips dracænæ PERGADE, Psyche, III, 1882, p. 381.

Parthenothrips dracænæ JORDAN, Zeit. f. Wiss. Zool., XLVII, 1888, pp. 541-820 (Biological part).

Parthenothrips dracænæ REUTER, Meddel af. Soc. Fauna et Flora Fennica, XVII, 1891, p. 166.

Heliothrips dracænæ TRYBOM, Entom. Tidskrift, 15 Årg., Häft 1-2, 1893, pp. 56-58.

Parthenothrips dracænæ UZEL, Mon. d. Ord. Thysanopt., 1895, pp. 171-173, pl. II, figs. 12-14; pl. VI, fig. 93.

Parthenothrips dracænæ TÜMPER, Die Geradflügler Mitteleuropas, 1901, p. 291.

Female.—Length about 1.15 mm.; width of mesothorax about 0.28 mm. General color dusky yellow, more or less strongly shaded with brown, especially upon the abdomen. Head, thorax, and wings covered with more or less clearly defined reticulating ridges.

Head widest in front through the eyes, four-fifths as wide as length; general shape quadrangular above, though front margin is somewhat elevated in middle; heavily reticulated; cheeks straight, but abruptly constricted at hind edge, neck-like; color quite uniform brownish yellow. Eyes black, very strongly protruding at fore angles; a slight depression surrounds each eye; ocelli small, approximate, with dark red margins contiguous, situated upon a slight elevation between the eyes and well removed from them. Maxillary palpi two segmented, the second segment being longer and more slender than the first. Antennæ seven segmented, very slender beyond second segment, about two and one-half times as long as the head; relative lengths of segments:

$\frac{1}{5}$	$\frac{2}{9.7}$	$\frac{3}{20.5}$	$\frac{4}{17}$	$\frac{5}{16.5}$	$\frac{6}{14.3}$	$\frac{7}{13.5}$
---------------	-----------------	------------------	----------------	------------------	------------------	------------------

Segment one nearly spherical, fully as long as broad, narrower than two, which is thickest; three to six subequal in thickness and about one-half the diameter of two, faintly ringed; seven very slender and bearing at its tip a still more slender spine, which may be nearly as long as the segment. Segments one and two slightly more dusky yellow than three to five; five is shaded with brown at its tip; six and seven brown or gray-brown.

Prothorax transverse, fully twice as wide as long and about two-thirds as long as the head, wider behind than in front; sides somewhat

rounded; surface reticulated like head and concolorous with it; one stout spine at each hind angle. Pterothorax on dorsal line only two-thirds as long as wide, one and one-fourth times as wide as prothorax; metathorax nearly as wide as mesothorax; color of pterothorax somewhat more yellow than head and prothorax; mesonotal plate deeply incised in middle behind; reticulations converging to anterior end of this incision. Wings very long and about one-tenth as broad, overreaching the abdomen considerably; form and venation unique; fore wings somewhat longer and about one and one-half times as broad as the hind wings; their front edge runs straight clear to the tip; the hind edge runs nearly parallel to it till near the end, where it curves forward to join the fore edge at the tip; the entire wing is bounded by one very heavy ring vein. There appears to be only one longitudinal vein; this at about basal fourth of wing curves forward to the costal vein, which it joins;^a then it curves backward and runs parallel with and quite close to the hind edge till it joins the ring vein before the tip. The costa bears no fringe, but is set with numerous stout spines as is also the longitudinal vein; hind edge bears a double fringe of long hairs; surface of fore wing shows faint reticulation. There are three rather faint brown spots on fore edge, the darkest being where the fore vein joins the costa, and one longer spot on hind edge; spines standing in these spots are much darker than the others. Legs concolorous with body, finely reticulated; hind coxæ approximate; fore femora brownish yellow, the others brown, yellowish at extremities; tibiæ and tarsi concolorous with second segment of antennæ; tarsi tipped with dark brown; spines very weak and light colored.

Abdomen distinctly wider than thorax and broadly joined to it; about twice as long as broad, ovoid, pointed at tip; general color brown or yellowish brown; last three segments yellow; sometimes the sides of each segment are much more yellow than its brown central area; anterior edge of segment one is curved forward very abruptly in the middle forming a rounded apex to the dorsal plate; prominent dark stripe on anterior edges of three to seven; anal spines weak and light.

Redescribed from five females taken in Amherst, Massachusetts, on *Kentia* and *Ficus*. I have no male, but Heeger says:

Male.—The abdomen in males is distinctly more slender than in females; is yellow-brown, thinly chitinated; about twice as long as the meso and metathorax together; almost cylindrical, with tapering anal extremity; naked, set with some long bristles only at the hinder edge of the last three abdominal segments.

Food plants.—*Dracæna*, *Ficus elastica*, *Kentia balmorina*.

^aI believe that the fore vein coincides with the costal from the spot where they join, the cross vein being more apparent than real, and that the vein which runs parallel with and close to the hind edge is really the hind vein.

Habitat.—Vienna (Heeger, v. Frauenfeld), Finland (Reuter), St. Petersburg (Regel), Germany (Jordan, Bohls), Bohemia (Uzel), United States: Washington, District of Columbia; Amherst, Massachusetts.

The early stages are described as follows:

Egg.—The eggs are nearly membranous, greenish white, elongate-ovate, $\frac{1}{15}$ " long, half as broad.

Larva.—Larvæ are milky white, nearly cylindrical; only the last three abdominal segments taper gradually to a blunt point; they are about $1\frac{1}{2}$ " long, $\frac{1}{4}$ as thick. The head is inverted conical, a little more slender but noticeably longer than the breadth of the abdomen; mouth parts are thin, horny, yellowish, pointed, snout-like. Eyes are on the sides of the head, circular, not raised; relatively large and clear red. The antennæ are thread-like, white with gray points, five segmented, somewhat longer than the head; first three segments small, cup-shaped, of equal size; fourth, spindle-shaped, about as long as first three together; fifth is gray, conical, very pointed, somewhat longer than the fourth.

The thorax is somewhat longer than the antennæ, swollen, flat beneath; prothorax is rounded-triangular, somewhat shorter than the pterothorax, the segments of which are grown together, and are elongated-rectangular and rounded. The legs are close together, with very large coxæ; nearly as long as the antennæ; middle pair noticeably shortest, hind pair longest; femora shorter and thicker than tibiæ, which are cylindrical; tarsi very short, indistinctly two segmented.

Abdomen spindle-shaped, nearly as broad and somewhat more than twice as long as the entire thorax; the nine segments are hardly perceptibly marked, equally long and set at sides with single, knobbed hairs.

Nymph or pupa.—The nymphs in the last days before their transformation are whitish, fusiform; their eyes are raised, round, and red; antennæ indistinctly eight segmented, laid back over the head near one another; wing sheaths lying at the sides of the abdomen, slender, bottle-shaped, reaching to the fore edge of the sixth segment and set with many transparent, white hairs, as is also the spindle-shaped abdomen; the hind edge of the next to the last and the end of the last segment set with single, knobbed hairs.

Genus THRIPS Linnæus.

Ocelli present. Antennæ seven segmented (style one segmented). Maxillary palpi three segmented. Prothorax regularly somewhat longer than the head; two long spines always present upon its posterior angles. Fore legs usually unarmed. Wings usually present, moderately broad, with fore fringe developed and veins set with short spines.

The species belonging here have the power of springing.

Although this is the largest genus of the order, I have here found but two species which I can place in it. These two may be easily distinguished by their colors.

Head brown, thorax reddish brown, abdomen yellow or gray-brown—*perplexus* (p. 184).
Color uniformly light yellowish varying to brownish yellow—*tabaci* (p. 179).

THRIPS TABACI Lindeman.

ONION THRIPS.

Plate VII, figs. 69-71.

- ? *Limothrips tritici* PACKARD, 2d Ann. Rept. Ins. of Mass., 1872, pp. 5-8, 2 figs.; 19th Ann. Rept. Secy. Mass. Bd. Agr. for 1871, pp. 333-336, 2 figs.; reprinted in 9th Ann. Rept. U. S. Geol. Geog. Surv. Territories for 1875, pp. 742-744, pl. LXVII, figs. 3-5.
Thrips on onion plants, SHIPLEY, Bull. 10, Miscell. Information Roy. Gardens, 1887, p. 18.
Thrips tabaci LINDEMAN, Die schädlichsten Insekten des Tabak in Bessarabien, 1888, p. 15, 61-75.
Thrips sp. THAXTER, Ann. Rept. Conn. Exp. Sta. for 1889, 1889, p. 180.
Thrips sp. RILEY-HOWARD, Insect Life, III, 1891, p. 301.
Thrips tabaci RITZEMA BOS, Tierische Schädlinge und Nutzlinge, 1891, pp. 577, 578.
Thrips tabaci TARGIONI-TOZZETTI, Animali ed Insetti del Tabacco in Erbal del Tabacco Secco, 1891, pp. 222-224.
Thrips sp. LINTNER, Count. Gent., LVII, Oct. 27, 1892, p. 809; Abstract in 9th Rept. Ins. N. Y., p. 445.
Limothrips sp. BAKER, Amer. Florist, VII, 1892, p. 168, fig.
Thrips striata? (GILLETTE, Ann. Rept. Col. Exp. Sta. for 1892, 1892, p. 36.
Thrips on onions, WEBSTER, Ins. Life, V, 1892, p. 127.
Thrips striatus GILLETTE, Bull. 24, Col. Exp. Sta., 1893, pp. 13-15, figs. 11, 12.
Thrips striatus RILEY-HOWARD, Ins. Life, VI, 1893, pp. 4-5, 343.
Thrips striatus? (GILLETTE, 5th Ann. Rept. Col. Agr. Exp. Sta. for 1892, 1893, p. 36; 6th Ann. Rept. Col. Agr. Exp. Sta. for 1893, p. 55.
Onion Thrips, SMITH, Ann. Rept. N. J. Agr. Col. Exp. Sta. for 1893, 1894, p. 441.
Limothrips tritici WEBSTER, Ins. Life, VII, 1894, p. 206.
Thrips allii SERRINE and LOWE, Bull. 83, N. S., N. Y. Agr. Exp. Sta., 1894, pp. 680-683, pl. II.
Thrips allii WEBSTER, Ohio Farmer, Aug. 2, 1894, p. 97; Aug. 23, 1894, p. 157; Nov. 7, 1894, p. 373.
Thrips allii SERRINE and LOWE, 13th Ann. Rept. N. Y. Exp. Sta. for 1894, 1895, pp. 758-760, pl.
Thrips allii OSBORN-MALLY, Bull. 27, Iowa Agr. Exp. Sta., 1895, pp. 139-142.
Thrips tabaci PERGANDÉ, Ins. Life, VII, 1895, pp. 392-395.
Limothrips tritici WEBSTER, Bull. 58, Ohio Agr. Exp. Sta., 1895, pp. xxxiii-xxxiv, fig. 3; also in Ins. Life, VII, 1895, p. 206.
Thrips communis UZEL, Mon. d. Ord. Thysanoptera, 1895, pp. 176-179, pl. VI, fig. 100.
Thrips tabaci UZEL, Mon. d. Ord. Thysanoptera, 1895, p. 447.
Thrips tabaci SLINGERLAND, Rural New Yorker, LV, 1896, p. 561.
Thrips tabaci FRANK, Die tierparasitären Krankheiten der Pflanzen, 1896, p. 134.
? *Thrips* sp. near *tabaci* DAVIS, Special Bull. 2, Mich. Agr. Exp. Sta., 1896, p. 13.

? Thrips on cabbages, SMITH, Economic Ent., 1896, p. 102.

? Thrips on cucumber, BRITTON, 20th Rept. Conn. Exp. Sta. for 1896, 1897.

Thrips tabaci SIRRINE, 15th Ann. Rept. N. Y. St. Exp. Sta. for 1896, 1897, pp. 612-613.

Onion Thrips, SIRRINE, Bull. 115, N. Y. Exp. Sta., 1897, p. 70.

Onion Thrips, SLINGERLAND, Rural New Yorker, May 8, 1897, p. 309.

Thrips tabaci LINTNER, 51st Ann. Rept. N. Y. St. Mus. Nat. Hist., 1898, p. 363; Separata, 13th Rept. Inj. Ins. N. Y., 1898, p. 33.

Thrips striatus GILLETTE, Bull. 47, Col. Exp. Sta., 1898, p. 44.

Thrips tabaci QUAINANCE, Bull. 46, Fla. Agr. Exp. Sta., 1898, pp. 103-114, figs. 10-12.

Thrips tabaci HOWARD, Yearbook, U. S. Dept. Agr. for 1898, 1899, pp. 142, 143, fig. 27.

Thrips tabaci PETTIT, Bull. 175, Mich. Exp. Sta., 1899, pp. 343-345, figs. 1, 2.

Thrips tabaci QUAINANCE, Bull. 20, N. S., U. S. Dept. Agr., p. 59. Remedies, various authors, 1899, p. 60.

Thrips tabaci WEBSTER-MALLY, Bull. 20, N. S., U. S. Dept. Agr., 1899, pp. 67-70.

Thrips in Greenhouses, FERNALD-HINDS, Bull. 67, Mass. Exp. Sta., 1900, pp. 9-12.

Thrips communis TÜMPER, Die Geradflügler Mitteleuropas, 1901, p. 293.

Thrips tabaci GARMAN, Bull. 91, Kentucky Exp. Sta., 1901, pp. 42-45.

Thrips tabaci WEBSTER, Journ. Columbus Hort. Soc., XVI, 1901, No. 3, 7 pp., 4 figs.

Thrips tabaci HINDS, Proc. 17th Ann. Conv. Soc. Amer. Florists, 1901, pp. 90-92.

Female.—Length about 1.1 mm.; width about one-fourth the length. Color quite uniformly light yellowish varying to brownish yellow.

Head one-fifth wider than long; cheeks slightly arched behind the eyes; frons slightly arcuate between them; occiput indistinctly transversely striated; hairs upon the head few and minute; eyes not protruding, coarsely granulated, very dark red by reflected light, black by transmitted light, sparsely pilose; ocelli subapproximate, standing well back to the line of the hinder edge of the eyes but posterior ocelli not contiguous with margins of eyes; color light yellow, margined inwardly with light brown crescents. Maxillary palpi three segmented; first and third segments equally long, second shorter. Antennæ seven segmented; relative lengths of segments as follows:

1	2	3	4	5	6	7
1.4	8.7	11.1	10	8.6	10.6	4

Segment one short and globose; two barrel-shaped; three to five pedunculate, elongated ovoid; five joined by moderately broad surface to base of six which tapers somewhat from its middle to its apical end; seven tapering slightly, blunt at apex. Segment one lightest in color, clear light yellow; two, six, and seven uniformly light grayish brown; three light brownish yellow; four and five colored like three at their bases but apices nearly as dark as six.

Prothorax as long as head, one-half wider than long; pronotum, indistinctly transversely striated and sparsely clothed with small spines; each hind angle bears a pair of very stout, conspicuous spines,

and between these pairs, along the hind edge of pronotum, stands a row of three smaller spines on each side. Metathorax one-third wider than prothorax; metanotal plate bears a few small spines. Wings about one-fourteenth as broad as long, slightly colored with light yellow; costal fringe of fore wings composed of short, stout bristles intermixed with a row of shorter spines. Fore longitudinal vein bears from ten to twelve spines arranged in three groups, as follows: Two groups upon the basal half of vein, the first of three or four spines, the second group of three, and beyond the middle of the wing four to six spines scattered at considerable distances along the vein to its tip; when only four are present in last group they stand at nearly equal distances apart; hind vein bears from fourteen to seventeen spines. Occasionally one or two cross veins may be seen between the fore vein and the costal at about one and two-thirds its length, but usually they are not present; hind vein arises from fore vein at about the middle of second group of spines. Hairs composing posterior fringes on both wings are long, slender, wavy, and light colored. Legs concolorous with body or somewhat lighter, quite long and slender; second segments of tarsi much longer than first; spines on inner side of hind tibiae weak, except the pair at its extremity; legs sparsely clothed with fine hairs.

Abdomen as wide, or slightly wider, than the mesothorax, about twice as long as wide; each dorsal plate of segments two to eight marked near its anterior edge with a narrow, transverse line of dark chestnut-brown color, widest at its middle and tapering gradually toward the sides, disappearing at the upper edge of the groups of three to five short spines which stand upon these segments just above the pleural plates. Posterior edge of ninth segment bears a circlet of eight long, stout spines, most prominent dorsally; terminal segment bears six spines which are nearly as long as the preceding; besides these long spines both of these segments bear a few finer spines.

Redescribed from many specimens.

Male.—"Head and abdomen yellowish white; thorax yellow. The first two antennal segments white, the third at the end very weakly, the fourth and fifth more strongly shaded with gray; the sixth is gray, at the base or even to the middle white; the seventh segment entirely gray. Wings present."—Uzel.

Food plants.—Apple, aster (cultivated), blanket flower, blue grass, cabbage, candytuft, catnip, cauliflower, celery, chickweed, cinquefoil, clover, coneflower, crab-grass, cucumber, dandelion, *Erechtites*, *Erigeron canadensis*, four-o'clock, garden leek, goldenrod, heal-all, honeysuckle, Jamestown weed, jimson, kale, melons, mignonette, mullein, nasturtium, onion, parsley, pink, plum, pumpkin, *Rubus* several species, shepherd's purse, *Specularia*, squash, stonecrop, sweet clover, timothy, tobacco, tomato, turnip, wheat.

Habitat.—Russia (Lindeman), England (Shipley), Italy (Targioni-Tozzetti), Bohemia, Helgoland (Uzel), Bermuda, United States: Massachusetts, Connecticut, New York, Long Island, Pennsylvania, New Jersey, District of Columbia, Virginia, Florida, Kentucky, Ohio, Indiana, Illinois, Iowa, Michigan, southern Canada, Colorado, California.

The early stages are described by Quaintance^a as follows:

Egg.—Length 0.26 mm.; width 0.12 mm.; in shape the egg is elliptical and curved. Fresh eggs are clear white. In eggs with advanced embryos, the reddish eyes are distinctly visible.

Larva, first stage.—(About one-half hour after hatching). Length, 0.38 mm.; width of thorax, 0.14 mm.; somewhat fusiform in shape; gradually tapering caudad from fourth or fifth abdominal segment; body, legs, and antennæ clear white; eyes reddish. Head in dorsal aspect about as broad as long; the eyes are situated at the cephalic lateral margins; no ocelli. In cephalic aspect the head is seen to be considerably produced—ventrad and caudad; suboval in outline. The four jointed antennæ are borne upon the vertex, and are approximate at base. Basal joint short, cylindrical, about half the length of second; second segment subpyriform, slightly longer than wide; third subspherical, about as long as second; fourth joint as long as the proximal three together, club-shaped, thickest near the basal third, tapering distally to a point. Joints three and four ringed; in the distal part of four these are much more pronounced, dividing it into what might be taken for short, indistinct segments. The antennæ bear setæ, which are much more numerous on fourth joint. Legs stout; coxa and trochanter short; femur about as long as tibia and tarsus together. The tarsus appears to be composed of but one joint, which terminates distally in two diverging claw-like processes; the bladder-like expansion on tip of tarsus does not seem to be present in this stage. Abdomen composed of ten segments; on the dorsum are four longitudinal acute setæ, and a row on each lateral margin. On the tenth segment these setæ are quite large, being from two to four times longer than the others.

Mature larva (second stage).—Length 0.94 mm.; width of mesothorax 0.22 mm. Body elongate; abdomen tapering caudad from about fifth segment. Head slightly longer than wide. Color greenish yellow, varying to greenish white. Legs and antennæ lighter; eyes reddish brown; ocelli wanting. Setæ practically as in stage 1. Antennæ four-jointed;^b basal joint short, cylindrical; second, subcylindrical, about twice as long as first. Third joint a fourth longer

^aQuaintance, Bull. 46, Fla. Agr. Exp. Sta.

^b"Lindeman regards the antennæ as six jointed, but to me joint four has not appeared to allow of being considered as made up of three joints, although there are four more or less well-defined parts, as determined by the rings, which, if considered as joints, would make seven in all, instead of six."

than second; subpyriform, united to second by narrow "neck," rather closely ringed. Fourth, about as long as proximal three together, club-shaped, ringed as in stage 1. Antennæ bearing setæ much more numerous on fourth joint. Tarsi without the pronounced claw-like structures of the first stage. In other respects essentially as in preceding stage.

Nymph (about two days old).—Length about 0.7 mm.; width of mesothorax about 0.15 mm.; color yellowish, varying to almost colorless; eyes reddish. Pupa-skin somewhat separated from the body proper, being particularly noticeable in the caudal end of the abdomen, wing-pads, legs, and antennæ. In these two latter the joints are very obscure, the pupa-skin covering them as a sheath. The wing-pads reach to about the eighth abdominal segment. There are numerous setæ on the body, antennæ, legs, and wing-pads. On the abdomen they have practically the same position as in the adult larva. The dorsal setæ of the last segment in the nymphs are very stout, almost hook-like, curving cephalad.

Life history.—Dr. Lindeman's conclusions, quoted by Dr. Lintner, are so different from those which have been reached by workers upon the same species in this country that we are led to suspect that he has confused the early stages of very different species.

In Massachusetts, using specimens found infesting a cucumber house in January and February, I have found that the egg stage varies from four to seven days. Pupation takes place in seven or eight days and lasts for nearly a week, when the adults emerge and after a few days lay their eggs. The whole life cycle in a greenhouse thus occupies from three to four weeks.

In Florida Quaintance found that the egg stage lasts in summer from three and a half to four days; the larval stage from seven to nine days, during which time the larva molted twice; the nymph stage four days, the total life cycle thus requiring about sixteen days. There appeared to be no distinct broods at any season.

In Ohio Professor Webster has found that this species hibernates in larval, pupal, and adult stages, the first predominating, being found in matted grass or refuse tops left in the onion fields, and that they safely passed through winters when the temperature fell to -23 to -25 degrees F.

Economic considerations.—Dr. A. S. Packard, in 1872, was the first to record the ravages of the "Onion Thrips," which he called *Limo-thrips tritici* Fitch, believing it to be identical with the "Wheat Thrips." While Dr. Packard's description is unidentifiable, it is sufficient to show that the insect was not *Thrips tritici* Fitch, nor did it belong to the genus *Limo-thrips*. Furthermore, Packard states that the antenna consists of eight segments, which would separate it from *Thrips tabaci*, which has only seven. Still the injury recorded is so like that which is known to have been committed by *Thrips tabaci* at

various times that I have included a reference to it under this species, though its correctness is questionable.

Dr. Packard found that this insect has been observed attacking onions for fifteen years previously, but the damage in 1872 was unusually severe in Essex County, Massachusetts, amounting that year to at least one-tenth of the crop, and having a money value in that one county of at least \$10,000.

In 1889, Dr. Thaxter found the Onion Thrips generally distributed and very injurious to onions in Connecticut, the injury produced being known as "White Blast."

The next report of very serious injury was made by Prof. C. P. Gillette from Colorado, where for several seasons it had been noticed as very abundant and doing considerable harm. It has also been found a serious pest all through the Middle States and in several of the Atlantic coast States as well as on the Pacific coast. This shows its very wide general distribution, and since its attacks seem to be most severe upon onions and cabbages—two important garden crops—it must be considered as, perhaps, the most injurious species of the order.

THRIPS PERPLEXUS (Beach).

Plate VI, figs. 66-68.

Sericothrips perplexa BEACH, Proc. Iowa Acad. Sciences, 1895, III, (1896), pp. 216-218.

Female.—Length 0.935 mm. (0.80 to 1.0 mm.); width of mesothorax 0.197 mm. (0.18 to 0.21 mm.). General color: head brown and thorax reddish orange-brown, very much darker than the pale yellow or gray-brown abdomen; body slender.

Head very large, somewhat pentagonal, approximately as long as broad or but slightly shorter, almost as large as prothorax, within which it is slightly withdrawn; cheeks nearly straight and parallel; anterior margin broadly elevated; without special prominences between bases of antennæ; occiput transversely wrinkled; without conspicuous spines. Eyes black, not protruding, together occupying about one-half the width of the head, margins lighter colored; ocelli conspicuous, large and well separated, placed far forward, all three being in front of the middle of the eyes, reddish yellow with maroon inward margins; ocellar bristles moderately long. Maxillary palpi three segmented. Antennæ fully twice as long as head, subapproximate; relative lengths of segments:

1	2	3	4	5	6	7
5.5	7.6	10.4	12	8.8	13	6.1

Segment one broader than two which is intermediate in thickness between two and three; three and four thickest at about their middle then tapering gradually to the ends; seven bluntly conical. Spines

long and slender, but not very conspicuous; those on three to five nearer the middle than usual. Color of one, two, five, six, and seven brown like head; three and four pale yellowish or gray; four shaded slightly with brown, increasing toward tip; basal constriction of five yellowish.

Prothorax not longer and but very slightly wider than the head, nearly square, without stout spines upon fore angles but with two long spines at each hind angle. Mesothorax about one and one-half times as wide as head, slightly wider than metathorax; greatest width at hind edge; color reddish or orange-brown. Wings reaching usually beyond the tip of abdomen, about one-seventeenth as broad as long; fore wing with two longitudinal veins; the origin of the hind vein indistinct; neither vein heavy; costa set with about twenty quite long spines besides the fringe hairs; fore vein bears ten to twelve rather weak spines and the hind vein about thirteen similar spines. Legs rather short; fore femora slightly thickened; yellow to gray-brown, bases of bladders dark brown; spines small except row of eight or nine on inner side of hind tibiae.

Abdomen nearly cylindrical and long, two and two-thirds times as long as wide; but very slightly wider than mesothorax; last three segments very short and tapering very abruptly to the acute apex. Color pale yellowish or grayish brown, very much lighter than thorax and head; ninth and tenth segments shading to brown-black; inter-segmental membranes pale yellowish or gray. Segments not overlapping; receptaculum seminis placed far back beneath eighth dorsal plate, very conspicuous, bright orange-red; ovipositor indistinct, vestigial; tenth segment split open above and sides nearly meeting beneath; anal spines long, slender, not very dark.

Redescribed from seven females taken on grass at Amherst, Massachusetts.

Male unknown.

Food plants.—*Cyperus* sp., corn and grass (Iowa), *Dactylis glomerata*, *Panicum sanguinale*, and various other grasses (Massachusetts).

Habitat.—Ames, Iowa; Amherst, Massachusetts.

These specimens have been compared with Miss Beach's types and are identical. The vestigial condition of the ovipositor, however, misled her into thinking her specimens all males, whereas they are really all females.

This species is exceptional among the Terebrantia in lacking a functional ovipositor, but it is surely vestigial in this case. The eggs are very large, while the ovipositor is disproportionately short and weak, and it seems that it must be impossible for this species to deposit its eggs in the plant tissue. In this respect they thus show a divergence toward the Tubulifera, which lay their eggs wholly exter-

nally. It also seems probable that the so-called "rod" of the Tubuliferan female is but the vestige of a former ovipositor. The wing venation also indicates that the *Æolothripidae* come nearest the primitive form and that *Phlæothripidae* have diverged farthest from the type, with the *Thripidae* somewhere in between. This species is therefore of considerable interest as possibly being one of the guide-posts to the phylogeny of the order Thysanoptera.

CHARACTERS OF TUBULIFERA (PLÆOTHRIPIDÆ).

The members of this suborder agree so closely in general characters that they have all been included in the single family *Phlæothripidae*. They are, as a rule, considerably larger and more powerfully formed than the *Terebrantia*, some of them being the giants of the order.

In the insects belonging to this suborder the head is always as long as broad, and may be two or three times as long. In most of those species which have comparatively short heads the front is smoothly rounded, but in those having very much elongated heads the vertex is considerably elevated, in some cases even forming a very prominent conical projection of the vertex beyond the bases of the antennæ. The eyes vary widely in size and number of facets. Ocelli are generally present. The cheeks are usually nearly straight and parallel, and in some species set with more or less numerous spine-bearing warts. Nearly every species has a pair of well-developed spines standing immediately behind the eyes, and therefore called post-ocular spines. The antennæ are invariably eight segmented in the adult stage and the sense cones on the intermediate segments are always simple. The mouth cone varies in form, being in some species short and blunt, and none of the external parts are acute at the tips; in others the labrum is abruptly constricted beyond the middle, its end forming a sharp spine-like process, which reaches beyond the broadly rounded labium; in still others the entire mouth cone, labium and all, is elongated and tapers to a quite slender tip, which, however, is not spine-like. These different forms of mouth cone have been thought to possess a generic value in classification, but my studies thus far have led me to the conclusion that too high a value has been placed upon this single character. The maxillary palpi have always two segments, of which the basal is very short, and the labial palpi are also two segmented, though frequently they are short and indistinct.

The prothorax has, in most cases, a trapezoidal form, and this is especially noticeable in those species in which the fore femora are much enlarged. The regularity of the outline of this trapezoid is, however, more apparent than real, as will be seen by reference to Plates VIII, IX, and X. The projecting fore coxæ fill in the hind angles so smoothly that in many cases careful focusing is necessary to show that the outline is not entirely that of the prothorax alone. The pro-

notum usually bears around its outer portion a number of conspicuous, long spines. The fore femora are frequently greatly enlarged, and when this is the case there will be found upon the fore tarsus a more or less stout tooth or hook. In most species the femora and tarsal teeth are larger in the males than in the females. The pterothorax is very compact and nearly rectangular in outline. The wings, which are usually present, are all very similar in form, venation, etc. They are either quite slender throughout or somewhat constricted near the middle, and are rounded at the tips. They have almost no veins, there being no ring or cross veins, and only one partially developed median vein in each wing. Along the margins of each wing there is borne a long, slender fringe, which is single except near the outer end of the hind margin of the fore wing, where it is double for a short distance. The membrane of each wing lacks microscopic spines such as are found upon the wings of Terebrantia. When brought to rest the wings are laid back closely upon the middle of the abdomen, so that they overlap in their second halves. They are here held in place, and the long, slender fringes confined by the rows of inwardly curved spines which stand upon each side of the second to seventh segments. In some species the wings are reduced to short, rounded pads, while in others even these are wanting.

The abdomen is very similar in both sexes, except that in the male it is usually more slender, especially through the sixth, seventh, and eighth segments. The female has no ovipositor. The sexual opening is between the ninth and tenth segments in both males and females. The last segment is a simple tube in both sexes and at its base, beneath, are found the distinctive sexual characters. The female is distinguished by a short, strongly chitinized rod upon the ninth segment near the base of the tube which is regular and entire. The male is distinguished by a semicircular notch in the base of the underside of the tube, providing an opening for the protrusion of the copulatory apparatus which is wholly retracted into the ninth segment. In many species the abdomen is somewhat flattened dorso-ventrally so that a cross section is elliptical in outline.

Tubuliferans live usually in secluded places, as between the parts of composite flowers, under the bark of trees, on the underside of foliage, in galls, moss, turf, fungi, etc. Their movements are very deliberate and they never run or spring.

SYNOPSIS OF PHLEOTHIRIPIDÆ.

- | | | |
|-----|--|---|
| 1 { | Body slender, head more than one and one-half times as long as wide | 8 |
| 1 { | Body more or less thickened, head less than one and one-half times as long as wide | 2 |
| 2 { | Breadth of abdomen of female nearly or quite one-half its length | 3 |
| 2 { | Breadth of abdomen of female not nearly equal to one-half its length | 4 |
| 3 { | Head broadly rounded in front, cheeks without warts <i>Trichothrips</i> (p. 191) | |
| 3 { | Head narrowed in front <i>Eurythrips</i> (p. 202) | |

4	Wings always present, usually inhabiting flowers	5
	Wings usually reduced, usually inhabiting bark or turf	7
5	Cheeks without spine-bearing warts	<i>Anthothrips</i> (p. 188)
	Cheeks with spine-bearing warts	6
6	Fore femora with teeth at tip within, intermediate antennal segments unusually long and slender	<i>Acanthothrips</i> (p. 198)
	Fore femora without teeth in female and usually in male, intermediate antennal segments not elongated	<i>Phlaothrips</i> (p. 195)
7	Head very large, rounded in front	<i>Cephalothrips</i> (p. 194)
	Head small, narrowed in front	<i>Malacothrips</i> (p. 200)
8	Head more than twice as long as wide	<i>Idolothrips</i> (p. 206)
	Head less than twice as long as wide	<i>Cryptothrips</i> (p. 205)

Genus ANTHOTHRIPS Uzel.

Head but little longer than wide, rounded in front; cheeks nearly parallel, without warts. Antennæ nearly twice as long as the head. Ocelli and wings always present in both sexes. Wings narrowed in the middle. Mouth cone not longer than the breadth at its base; labrum narrowed toward tip but not sharply pointed. Fore tarsi armed with a tiny tooth which is somewhat larger in males than in females. Males without a scale at base of tube.

The two species belonging here may be easily separated by the presence or absence of spines upon the head. In *A. niger* (p. 188) the cheeks are smooth, without spines, and there are no post-ocular spines, while in *A. verbasci* (p. 189) the cheeks bear small spines not standing on warts and the post-ocular spines are well developed.

ANTHOTHRIPS NIGER (Osborn).

Plate VII, figs. 72-75.

Phlaothrips nigra OSBORN, Canad. Entom., XV, 1883, p. 154; Rept. U. S. Dept. Agr. for 1887, (1888), pp. 163, 164; Ins. Life, I, 1888, pp. 137-142; Ins. Life, V, 1892, pp. 112-113.—DAVIS, Bull. 116, Mich. Agr. Exp. Sta., 1894, pp. 62, 63.

Anthothrips nigra UZEL, Mon. d. Ord. Thysanoptera, 1895, p. 242.

Female.—Length 1.5 mm. (1.1 to 1.8 mm.); width of mesothorax 0.34 mm. (0.3 to 0.4 mm.). General color more or less dark reddish brown.

Head approximately as long as broad, longer than prothorax, smoothly rounded in front; cheeks straight, parallel, and without warts. Eyes small, finely faceted; ocelli quite large and well separated, posterior ocelli almost contiguous with margins of eyes; no post-ocular bristles. Mouth cone shorter than its breadth at base and blunt at tip. Antennæ subapproximate, as long as width of mesothorax; segments quite short and stout; fourth thickest and most rounded; relative lengths of segments as follows:

1	2	3	4	5	6	7	8
11.4	11.4	12.8	12.9	11.5	10.7	10.6	7.4

Color nearly uniform brown; three and base of four yellowish brown; spines short and weak; sense cones short and blunt.

Prothorax one-half as long as breadth to outer angles of coxæ; front and hind edges nearly parallel, gently curved; one short spine at each posterior angle and one nearly halfway between this and middle of hind edge. Mesothorax somewhat wider than prothorax but usually less than twice as wide as the head; sides of pterothorax nearly straight, shorter than its breadth. Legs short and moderately stout; fore femora but slightly thickened; fore tarsi armed with a tiny tooth near tip within; middle and hind tibiae with one prominent spine externally at tip. Legs brown; middle and hind tarsi slightly yellowish, sometimes brown; fore tarsi and tip of tibiae yellow. Wings always present, narrower in middle than at ends, shaded with brown only at base, where fore wing bears three erect spines. Wings and fringes nearly equal; fringes single, except on hind border of fore wing near tip, where for seven or eight hairs they are double.

Abdomen about twice as broad as head, averaging about two and one-half times as long as wide; segments overlapping somewhat; sides nearly parallel to middle, then tapering gradually to base of tube. Tube about four-fifths as long as head, only slightly tapering; sides straight; terminal spines shorter than tube. All spines on abdomen short, weak, and not conspicuous.

Redescribed from seven specimens.

Male unknown.

Food plants.—*Achillea millefolium*, ox-eye daisy, red clover, white clover, various grasses.

Habitat.—Iowa, Michigan, Massachusetts.

ANTHOTHIRIPS VERBASCI (Osborn).

Plate VII, figs. 76-78.

——— OSBORN, Ins. Life, I, 1888, pp. 137-142.

Phlaothrips verbasci OSBORN, Proc. Iowa Acad. Sc., III, 1896, p. 228.

Female.—Length 1.8 mm. (1.42 to 2.12 mm.); width of mesothorax 0.38 mm. (0.32 to 0.44 mm.). General color dark brown.

Head but slightly, if any, longer than wide; cheeks nearly straight and parallel, set with few minute spines; post-ocular bristles prominent; hind margin of head not covered by front margin of prothorax. Eyes finely and closely faceted, rounded, not protruding; ocelli widely separated, posterior ones contiguous with the light margins of eyes; front ocellus placed at extreme vertex. Mouth cone about as long as it is broad at base, pointed. Antennæ approximate, almost twice as long as head; relative lengths of segments:

1	2	3	4	5	6	7	8
9	12	15	15	15	14	12.6	10.6

Segment three clavate; four fusiform; five and six becoming more slender and less fusiform; seven cylindrical; eight sharply conical. Segment one and base of two dark brown; tip of two, seven, and eight yellowish brown; intermediate segments pale yellow. Spines pale and weak; sense cones short and blunt.

Prothorax short, only about three-fourths as long as head; fore and hind margins nearly parallel and curving backward; one stout spine at each angle, one in middle of sides, and one on each side between those at the angle and the median line on both fore and hind margins; hind angles appear to entirely cover the fore coxae as a rule; each fore coxa bears one stout spine. All these stout spines are blunt but not knobbed. Sides of pterothorax full and smooth; fore angles oblique; color of thorax uniform dark brown or yellowish brown, more or less irregularly mottled with dark red. Wings present, narrowed in middle, transparent except at base, where the fore wing bears three long spines upon the remnant of the single median vein. Fringes long, single, except near end of hind fringe of fore wing where it is double for ten or twelve hairs. Legs moderately long and slender; fore femora only slightly thickened; fore tarsus one segmented and armed with a tiny tooth. All femora and middle and hind tibiae dark brown; middle and hind tarsi slightly yellowish or grayish brown; fore tibiae and tarsi bright yellow like middle of antennæ; fore tibiae shaded a little with brown toward their bases outside. One long slender spine near base of each fore femur below; each fore coxa with one long spine.

Abdomen broadly joined to metathorax and but slightly wider, widest at base but less than twice as wide as head; segments more or less imbricate, tapering gradually to tube. Tube about four-fifths as long as head, tapering slightly, not swollen at base, bearing a circlet of spines at tip which are shorter than the tube. All spines on abdominal segments slender and rather faint; color of abdomen quite uniform yellowish brown to dark brown. In the lightest colored specimens the irregular dark mottlings show up most prominently.

Redescribed from eight females.

Male.—The male agrees quite closely with the foregoing description; it is usually somewhat smaller throughout; relative lengths of antennal segments are as follows:

1	2	3	4	5	6	7	8
8.5	11.5	13.5	14.5	14	12.8	12	10

Fore tarsi are armed with a medium-sized tooth, which is larger than that in the female. Of the four spines standing near the hind edge of the ninth segment, the outer pair is very short, stout, and acute; the abdomen seems to be somewhat more slender than in female.

Described from four males.

Food plant.—Mullein.

Habitat.—Ames, Iowa; Amherst, Massachusetts.

Genus TRICHOTHRIPS Uzel.

Head about as broad as long, broadly rounded in front. Eyes small. Ocelli present in both these species, but often wanting. Mouth cone not longer than its breadth at base; labrum pointed at tip. Fore femora somewhat enlarged and tarsi armed with a tooth. Wings usually wanting, but present in both these species, slender throughout. Abdomen very broad and heavy; tube very slender in proportion to width of abdomen; no scale at base of tube in the male.

The two species which I have placed in this genus may be distinguished by the following characters:

Tube fully as long as the head *beurli* (p. 192)
 Tube two-thirds as long as the head *ambitus* (p. 191)

TRICHOTHRIPS AMBITUS, new species.

Plate VIII, figs. 81, 82.

Female.—Length 2 mm.; width of mesothorax 0.45 mm. General color brownish yellow shading to brown or reddish brown.

Head slightly longer than wide, widest just behind the eyes, rounded in front; cheeks straight and converging posteriorly; at hind edge only six-sevenths the diameter at widest part; frons slightly elevated between bases of antennæ; post-ocular bristles present; a few scattering small spines upon head not raised upon warts; surface faintly reticulated. Anterior half of head light brown flecked with reddish, posterior half fading to yellow at the neck. Eyes small, finely granulated, compact, not pilose, purplish by transmitted light, reddish orange by reflected light; ocelli present, subapproximate, pale yellow margined inwardly with reddish brown crescents. Mouth cone reaching nearly to posterior edge of prosternum; maxillary palpi two segmented; labial palpi short and thick; labium broad and rounded; maxillæ converging abruptly below the palpi and short. Antennæ one and three-fourths times as long as the head, eight segmented, though the joint between seven and eight is very indistinct; relative lengths of segments as follows:

$$\frac{1}{12} \quad \frac{2}{18} \quad \frac{3}{28} \quad \frac{4}{26} \quad \frac{5}{21} \quad \frac{6}{20} \quad \frac{7}{15} \quad \frac{8}{8}$$

Segment one truncate, conical; two constricted toward base into a broad stalk, cut off squarely at end; three to seven slenderly stalked at bases; three to six clavate; seven cylindrical-ovate, very closely united by full width of end to eight which is conical. Color of one pale brownish yellow; two and three clear yellow; four yellow at base

shading to light brown at end; remaining segments dark brown. Sense cones on segments three to six very long and slender; transparent spines upon each segment also long and slender.

Prothorax three-fourths as long as head and three fifths as long as wide; fore coxæ project considerably beyond posterior angles. One medium length spine on each side of middle and near anterior edge, one near each anterior angle, one at middle of each side and one longer one at each posterior angle. Mesothorax equal in width to prothorax and concolorous with it; mesonotum bears one long spine close to base of each fore wing. Metathorax equal in width to mesothorax, narrowed but very slightly posteriorly, pale yellow in middle, shaded on sides, splashed with red. Each fore coxa bears a single long spine on outer side; fore femora somewhat enlarged; each femur bears a single long, erect spine on the outer side near its extremity; tarsi short and thick, fore pair armed with a stout tooth. Femora gray-brown, fore pair yellowish brown; fore tibiæ and tarsi pale yellow; middle and hind tibiæ and tarsi almost white. Wings reaching to tip of abdomen; both pairs equal in size, edges parallel, heavily fringed; fore wings bearing a costal group of three long slender spines between the fringe and base of wing. Color of wings clear, transparent, except a slightly clouded band across fore wings at about one-third their length.

Abdomen broad and heavy; last three segments tapering abruptly; at sixth segment one and one-sixth times as broad as thorax. Tube two-thirds as long as head and at middle one-seventh as broad as the fourth abdominal segment; terminal spines about as long as tube. A stout bristle projects anteriorly from each side angle of first segment; each following segment, except tube, bears on each side one spine; these are short upon first segment and increase in length and size posteriorly. Color brownish yellow in middle, shaded with dark reddish brown on sides; tube bright brownish yellow tipped abruptly with gray-brown.

Described from one female.

Male unknown.

Food plant.—Grass.

Habitat.—Amherst, Massachusetts.

TRICHOTHRIPS BEACHI, new species.

Plate VII, fig. 79; Plate VIII, fig. 80.

Female.—Length 1.81 mm. (abdominal segments one-third telescoped); width of mesothorax 0.48 mm. General color yellow-brown. Head as broad as long, rounded in front; cheeks slightly converging behind the middle, set with scattered, small, stout spines borne upon small warts; post-ocular bristles quite long and acute. Eyes small, finely faceted, rounded; ocelli large, distant, posterior two almost

contiguous with light yellowish margins around eyes, color reddish yellow. Antennæ more than twice as long as the head; length and breadth of segments increase gradually from base to middle, then decrease to tip of antenna; relative lengths of segments as follows:

$\frac{1}{9}$	$\frac{2}{15}$	$\frac{3}{22}$	$\frac{4}{22}$	$\frac{5}{19}$	$\frac{6}{17}$	$\frac{7}{14.5}$	$\frac{8}{13}$
---------------	----------------	----------------	----------------	----------------	----------------	------------------	----------------

Color dark brown; bases of three to five yellowish; spines of medium length, but not very conspicuous; sense cones about one-third of the length of the segment bearing them.

Prothorax about five-sixths as long as head, and nearly twice as broad as long, broadly rounded at hind edge; spines upon fore edge much smaller and weaker than the mid-lateral and those on hind edge; all these spines are acute. Mesothorax about one and one-half times as wide as prothorax, uniting closely and evenly with metathorax so that sides of pterothorax are nearly straight. Wings present, long and powerful; fringes long, double for from nine to eleven hairs in hind fringe of fore wing near tip. Legs of medium size and length; fore femora a little thickened and tarsi armed with a very tiny tooth; middle legs much the smallest. All femora chestnut brown; tibiae at base brown, fading to yellowish at tips; fore tibiae lightest; tarsi yellow. Fore coxæ project a little beyond sides of prothorax and each bears one long spine; each femur bears one long slender spine on under side near base; three or four long slender spines stand around tips of middle and hind tibiae.

Abdomen large and heavy, somewhat broader than thorax, slightly more than twice as broad as head; segments overlapping about one-third; sides nearly parallel up to eighth segment, then tapering very abruptly. Tube slender in middle, about one-eighth the breadth of the abdomen, fully as long as the head, tapering but slightly; terminal circlet of spines shorter than tube; spines on abdomen light colored.

Color of whole body generally yellowish brown, lightest along middle of back of thorax and abdomen; abdomen darkest where segments overlap; thorax and abdomen show some irregular dark red hypodermal pigmentation. All spines acute.

Described from one female taken under quince bark in early spring, together with many bright-red larvæ around it.

Male unknown.

Food plant.—Taken under quince bark.

Habitat.—Amherst, Massachusetts.

I take pleasure in naming this species for Miss Alice M. Beach, in recognition of her work upon the Thripidae of Iowa.

Genus CEPHALOTHRIPS Uzel.

Head considerably longer than its breadth or the length of the prothorax, broadly rounded in front and larger than in most species in proportion to the other segments. Eyes small; ocelli present. Antennæ about one and one-half times the length of the head. Mouth cone shorter than its breadth at base; labrum not narrowed in the middle and ending in a blunt point. Fore femora slightly thickened and tarsi with a tiny tooth. Wings usually reduced or wanting entirely. Male without a scale at base of the tube.

I place here only one species, *ynceus*.

CEPHALOTHRIPS YUCCÆ, new species.

Plate VIII, figs. 83, 84.

Female.—Length 1.48 mm. (1.40 to 1.56 mm.); width of mesothorax 0.29 mm. (0.28 to 0.30 mm.). General color yellowish brown, irregularly mottled with dark-red hypodermal pigmentation.

Head broad and large, about one and two-fifths times as long as wide; cheeks slightly arched and smoothly joined to eyes, converging slightly toward neck; front smoothly rounded; post-ocular bristles present, but rather small and not prominent; cheeks smooth. Eyes small, each being less than one-fourth the breadth of the head through them, triangular above and surface even with that of head, very dark red in color; ocelli small, situated far forward, quite widely separated, with very dark red inner margins. Mouth cone short and rather blunt. Antennæ nearly one and one-half times as long as head, considerably separated at bases with but slight elevation between them; relative lengths of segments as follows:

1	2	3	4	5	6	7	8
6.5	11.6	12.5	12.5	11.8	11.3	11.2	8.25

Segments three to five subequal in breadth and similar in shape. Antennæ yellow, segments one and two shaded with brownish. Sense cones quite long and slender; spines shorter and light colored, so inconspicuous.

Prothorax two-thirds as long as head and across outer angles of coxæ about one and two-fifths times as wide as head; sides of thorax really considerably indented above fore coxæ. Anterior marginal and mid-lateral spines wanting; those at angles present, but weak and inconspicuous. Pterothorax as broad as prothorax through coxæ, equal to about one-fifth the length of the body; its sides straight and parallel; about four-fifths as broad as abdomen. Wings usually reduced to mere pads, but when occasionally present they are of moderate length, though not very powerful. (Winged specimens have the

pterothorax nearly as wide as the abdomen.) Legs rather short and thick; fore coxæ project somewhat beyond thorax; fore femora slightly thickened and the tarsi armed with a tiny tooth; tibia of each leg slightly shorter than its femur; all tarsi short and thick. All femora and middle and hind tibiæ brown; all tarsi and fore tibiæ, except at base outside, pale yellow; a prominent brown spot at tip of tarsi within.

Abdomen about three-fifths the length of the body; about one and one-fourth times as broad as the mesothorax; nearly cylindrical to seventh segment, then sides curve smoothly to base of tube. Tube less than one-half as long as head and at middle only about one-ninth the breadth at middle of abdomen. Spines on abdomen of moderate length, slender, acute, light colored, and not prominent. The abdomen is darkest at sides and tip; on each side of segments two to eight, slightly outside the line of wing-confining spines, there is a rounded or elliptical clear yellow spot. The body lacks any striking coloration.

Described from ten wingless and two winged females.

Cotype.—Cat. No. 6331, U.S.N.M.

Male.—The males are about five-sixths as large as females. Their antennæ are about one and two-fifths times as long as the head; there appears to be less difference in the length of antennal segments than in female; relative lengths of segments as follows:

$\frac{1}{6}$	$\frac{2}{10}$	$\frac{3}{11}$	$\frac{4}{10.25}$	$\frac{5}{10}$	$\frac{6}{9.75}$	$\frac{7}{9.75}$	$\frac{8}{7.1}$
---------------	----------------	----------------	-------------------	----------------	------------------	------------------	-----------------

Abdomen about one and one-fifth times as broad as mesothorax; tube about one-half as long as head and at middle about two-fifteenths as broad as middle of abdomen.

Described from nine males, all short winged. All of my males were taken in September, and it may be that winged specimens occur earlier in the season.

Cotype.—Cat. No. 6331, U.S.N.M.

Food plants.—*Yucca filamentosa*, goldenrod.

Habitat.—Amherst, Massachusetts; Washington, District of Columbia.

Genus PHLÆOTHRIPS Haliday.

Head somewhat longer than wide; cheeks with small warts, each bearing a tiny spine. Intermediate antennal segments not particularly elongated; the whole antenna less than twice as long as head. Mouth cone as long or longer than its breadth at base and narrowed; labrum sharply pointed at tip. Fore femur enlarged and tarsus armed with a tooth. Wings not narrowed in middle, present in both sexes. No scale at base of tube in male.

I place two species in this genus. They may be separated by the following characters:

All femora dark brown; tibiae and tarsi bright yellow.....*uzeli* (p. 196).
Legs gray-brown; tarsi somewhat lighter; fore tibiae yellowish....*pergandeii* (p. 197).

The female of the species *uzeli* comes within the definition of the genus *Phlaeothrips*, but the male of this species has the teeth at the tip of the fore femora, which is the principal character upon which Uzel has separated his genus *Acanthothrips*. This species, therefore, appears to unite the characters of these two genera, and as more emphasis is placed upon the description of the female than upon that of the male, I have preferred to include this species in the established genus *Phlaeothrips* rather than to erect a new genus for it.

PHLÆOTHRIPS UZELI, new species.

Plate VIII, figs. 87-90; Plate IX, figs. 91, 92.

Female.—Length 1.76 mm. (1.72 to 1.86 mm.); width of mesothorax 0.39 mm. (0.38 to 0.40 mm.). General color dark brown with yellow tibiae and tarsi.

Head about one and one-fourth times as long as wide, rounded in front; cheeks nearly straight and parallel, set with several short, stout spines borne upon small warts; post-ocular bristles quite long and knobbed. Eyes moderately large, rounded, finely faceted; ocelli prominent, distant, reddish yellow, posterior ones contiguous with light borders of eyes. Mouth cone long and pointed, reaching to posterior edge of prosternum. Antennæ about one and three-fourths times as long as the head, slightly more than twice as long as width of head; relative lengths of segments as follows:

1	2	3	4	5	6	7	8
9.7	12.3	18	18.3	16	14.3	13.3	8.5

Segments one and two dark brown; three brownish yellow, lightest at base; four to six light brown, pale yellow at base; seven and eight light brown; spines long but not very dark colored; sense cones over one-third the length of the segment bearing them.

Prothorax two-thirds as long as head, and to angles of coxæ twice as wide as long; usual anterior marginal, posterior marginal and mid-lateral spines present, knobbed. Mesothorax slightly wider than prothorax; sides of pterothorax straight and converging a little to base of abdomen. Wings long and powerful. Legs of medium length and quite stout; fore femora somewhat thickened and the tarsi armed with a small tooth; middle of outer surface of each fore tibia and femur supports one long slender spine near the base on under side. All femora dark brown; all tibiae and tarsi bright yellow, the middle and hind ones being slightly shaded with brown.

Abdomen large and stout, about four times as long as head, as wide as mesothorax; sides nearly parallel to seventh segment, from there tapering roundly to base of tube; segments overlapping about one-third. Tube four-fifths as long as head; sides straight and converging slightly; breadth in middle one-seventh that in middle of abdomen; terminal circle of hairs about the length of the tube, very slender. Spines on sides of abdomen blunt; abdomen quite uniformly yellowish brown (dark brown where segments overlap).

Described from three females.

Cotype.—Cat. No. 6332, U.S.N.M.

Mule.—Males about six-sevenths as large as females. Cheeks slightly fuller; relative lengths of antennal segments as follows:

$\frac{1}{8}$	$\frac{2}{11}$	$\frac{3}{15.6}$	$\frac{4}{15.9}$	$\frac{5}{13.9}$	$\frac{6}{12.4}$	$\frac{7}{11}$	$\frac{8}{7.9}$
---------------	----------------	------------------	------------------	------------------	------------------	----------------	-----------------

Fore femora larger than in female and terminating in two teeth at tip within; fore tibiae have each a small tooth near base within; teeth on fore tarsi large. (The teeth upon femora and tibiae are not found at all in the female of this species.) Tube at middle about one-sixth the width at middle of abdomen; abdomen tapering slightly.

Described from five males.

Cotype.—Cat. No. 6332, U.S.N.M.

Food plants.—Taken on various grasses, clover, and *Ulmus montana* var. *pendula*.

Habitat.—Amherst, Massachusetts.

This species is named for Dr. Henry Uzel, of Königgrätz, Bohemia, whose Monograph of the Order Thysanoptera is by far the best work that has been published upon this order.

PHLEOTHrips PERGANDEI, new species.

Plate VIII, figs. 85, 86.

Female.—Length 1.68 mm. (abdominal segments overlapping for about one-fourth their length); width of mesothorax 0.42 mm. General color yellowish brown, with considerable irregular red hypodermal pigmentation.

Head about one-sixth longer than wide, widest close behind the eyes, rounded in front; cheeks slightly curved and bulging behind eyes, converging slightly posteriorly, set with a number of short, stout spines borne upon quite prominent warts; post-ocular bristles long and knobbed. Eyes about medium in size, slightly elongated, finely faceted; ocelli quite large, distinct, subapproximate, reddish yellow with dark red crescentic margins, situated well forward upon vertex, which is slightly elevated. Mouth cone quite long, reaching to back of prosternum; labrum sharply pointed and overreaching the

labium. Antennæ twice as long as width of head; relative lengths of segments as follows:

$\frac{1}{10}$	$\frac{2}{14}$	$\frac{3}{22}$	$\frac{4}{21}$	$\frac{5}{17}$	$\frac{6}{14}$	$\frac{7}{13}$	$\frac{8}{8.5}$
----------------	----------------	----------------	----------------	----------------	----------------	----------------	-----------------

Color of antennæ brown with bases of three, four, five, and six decreasing in area and intensity of yellowishness; sense cones about one-third the length of segment three; spines quite long, dark, and conspicuous.

Prothorax only five-sevenths as long as head, and to outer angles of fore coxæ slightly more than twice as wide as long; usual prothoracic spines present, quite long and knobbed. Mesothorax as wide as width across fore coxæ, closely joined with prothorax; pterothorax very compact, sides converging slightly to base of abdomen. Wings long and powerful. Legs quite strong; fore femora much thickened, over one-half as broad as head; fore tarsi armed with a small tooth. Color of legs uniformly gray-brown; tarsi somewhat lighter; fore tibiae yellowish, shaded with brown at bases and on top.

Abdomen less than twice as broad as head, equal in width to mesothorax, nearly cylindrical to eighth segment; eighth and ninth tapering abruptly to base of tube. Tube only two-thirds as long as head; sides straight, tapering somewhat; breadth in middle about one-eighth that of middle of abdomen; terminal hairs a little longer than tube. All large spines on body, except those on hind edge of nine and at tip of tube are short and knobbed; those on nine and tube are acute. Color of abdomen pale brownish yellow, lightest in middle; blood-red pigmented tissue confined mostly to sides of abdomen in this specimen.

Described from one female.

Male unknown.

Food plant.—Taken on grass.

Habitat.—Amherst, Massachusetts.

I name this species for Mr. Theodore Pergande, by whom several of our native species have been described.

Genus ACANTHOTHIRIPS Uzel.

Head somewhat longer than wide; cheeks with spine-bearing warts. Antennæ very nearly twice as long as head; intermediate segments elongated and bearing very long sense cones. Mouth cone considerably longer than its breadth at base and quite slender. Fore femora enlarged in both sexes and with one or two teeth at tip within; tarsus armed with a stout tooth (Uzel says the tooth is weaker in the male than in the female). Wings present in both sexes. No scale at base of tube in the male.

I have placed the single species *magnafemoralis* in this genus, though I do not know the female. The characters of the fore femora and antennæ are sufficient to separate it generically from *Phlaothrips*.

ACANTHOTHrips MAGNAFEMORALIS, new species.

Plate IX, figs. 93, 94.

Male.—Length 2.16 mm.; width of mesothorax 0.42 mm. General color yellowish brown with antennæ, legs, and eighth and ninth abdominal segments banded with nearly transparent or yellowish white.

Head nearly one and one-fourth times as long as wide; cheeks bulging abruptly and greatly behind the eyes, then converging to the neck, which is as wide as the diameter through the eyes; cheeks, especially anterior parts, set with short spines borne upon very prominent tubercles; front between eyes very narrow, carinated. Eyes large, finely faceted, reniform above, inner edges parallel; ocelli small, approximate, and placed between the middle of the eyes. Proboscis long, slender, pointed; labrum sharply pointed. Antennæ scarcely twice as long as the head and very slender; relative lengths of segments as follows:

1	2	3	4	5	6	7	8
$\frac{1}{10}$	$\frac{2}{12}$	$\frac{3}{29}$	$\frac{4}{26}$	$\frac{5}{23}$	$\frac{6}{15}$	$\frac{7}{15}$	$\frac{8}{9}$

Segments one to five subequal in thickness; three to five similar in shape, elongated, urn-shaped; eight sharply conical. Segments one, two, seven, and eight quite uniformly dark brown; bases of three to five and tips of three and four pale yellowish, nearly white on three; six entirely pale yellow, with slight brownish tinge on outer half; antennæ appear annulated with pale yellow and dark brown. Spines and sense cones long, slender, and light colored; the cones on three to five fully one-third the length of segment three and on six about three-fifths its length.

Prothorax about two-thirds as long as head; width to outer angles of coxæ nearly twice its length; transverse margin nearly straight; the usual stout spines on thorax and abdomen, except those at tip of tube, are extremely short and blunt. Mesothorax slightly wider than the abdomen; middle of pterothorax concaved slightly. Wings long and rather slender. Legs moderately long; fore femora extremely thick and large, almost as wide as length of fore tibiæ; fore femora armed with a stout tooth at the tip within; fore tibiæ bent outward at base; fore tarsi one segmented, armed with a very stout tooth; middle and hind tibiæ rather short and swollen in the middle, their tibiæ quite slender and their tarsi two segmented. Fore femora yellowish brown; fore tibiæ and tarsi pale yellowish, tibiæ alone shaded with brown on middle of outside; middle and hind femora almost transparent white at base, outer half shaded with brown and having a

roundish, light yellowish spot on side of dark area; middle and hind tibiae pale yellowish at base and tip, banded with dark brown around the middle, these tarsi pale yellow, brown at tips; surface of all legs rough, being thickly set with minute warts, each bearing a small spine.

Abdomen about two-thirds the length of the body, tapering gradually from second segment to tip; width at second segment but slightly less than that of mesothorax. Tube slightly more than three-fourths as long as head; diameter at middle of tube about one-sixth that at middle of abdomen. Sides of metathorax and surface of abdomen, up to about the seventh or eighth segment, peculiarly roughened with closely set small warts, many of which bear small spines. The tube is nearly cylindrical, without a scale at its base, and at the tip bears a circlet of eight extremely long, slender, acute hairs, which are nearly three times as long as tube. The basal third of tube is very pale yellowish white; the outer two-thirds is abruptly brown-black; segments eight and nine pale yellow; three to seven appear irregularly striped with pale yellow and dark brown; dorsal stripe pale yellow and about the width of the wings; a subdorsal row of dark-brown, semicircular spots, which stand one in the middle on each side of these segments with the straight side toward the dorsal line, gives the appearance of a subdorsal stripe; then follows on each side an irregular, pale yellow stripe, and the middle of the sides of the segments is shaded with brown. Spines on sides of abdominal segments and the back of eighth and ninth are extremely short and blunt.

Described from one specimen.

Female unknown.

Food plant.—?

Habitat.—Miami, Florida.

MALACOTHRIPS, new genus.

Head plainly longer than wide and narrowed in front. Cheeks full and with spine-bearing warts; vertex elevated. Antennae nearly twice as long as head. Mouth cone as long as its breadth at base, reaching the hind edge of the prosternum; labrum quite sharply pointed at tip. Prothorax two-thirds as long as head. Pterothorax somewhat constricted in middle. Fore tarsi with a tiny tooth. Wings usually reduced to pads. Abdomen large and full in the female. A closely lying scale at base of tube in the male.

This genus contains only one species, *zonatus*.

(μαλακος, soft; θρῖψ.)

MALACOTHRIPS ZONATUS, new species.

Plate IX, figs. 95-98.

Female.—Length 1.62 mm. (1.50 to 1.68 mm.); width of pterothorax 0.80 mm. (0.72 to 0.84 mm.). General color pale bright yellow on

thorax and segments one, three, four, and five of the abdomen; head and other abdominal segments brown. Body apparently weakly chitinized.

Head nearly one and one-third times as long as wide, narrowed in front; cheeks moderately full and set with a few small spines borne upon small warts; head appears constricted close behind the eyes, and slightly so at neck; post-ocular bristles well developed; front of head between eyes developed into a prominence bearing the antennæ; vertex produced into a sort of hump, which, however, does not overreach the insertion of the antennæ. Eyes small, finely faceted, dark purplish red, surrounded by pale yellow margins; ocelli present, subapproximate, borne well forward upon the hump, the front ocellus being upon its vertex; pigmentation around ocelli bright red. Mouth cone moderately long and slender; labrum abruptly constricted and sharply pointed at tip. Antennæ approximate at base, almost twice as long as head; relative lengths of segments as follows:

$\frac{1}{9.8}$	$\frac{2}{13.5}$	$\frac{3}{13.4}$	$\frac{4}{16.5}$	$\frac{5}{15.8}$	$\frac{6}{13.9}$	$\frac{7}{12.4}$	$\frac{8}{11.4}$
-----------------	------------------	------------------	------------------	------------------	------------------	------------------	------------------

Basal segments large, truncate-conical, placed divergently; three clavate; from three to eight the segments become gradually more narrow. Antennæ nearly uniformly brown, except three, which is yellowish brown; spines and sense cones quite long, but slender and light colored, so inconspicuous.

Prothorax about two-thirds as long as head and across outer angles of coxæ about twice as wide as long. All the usual prominent prothoracic spines well developed, but light colored; hind margin not sharply defined. Pterothorax in middle slightly narrower than width across fore coxæ; mesothorax short, slightly narrower than metathorax and slightly brownish yellow in color. Wings reduced to very small pads, each fore pad bearing three quite long, blunt spines. Legs of medium length and middle and hind pairs quite slender; fore coxæ projecting considerably beyond thorax; fore femora slightly thickened and tarsi armed with a small tooth. All legs pale yellow or pale brownish yellow with prominent brown spot within tip of tarsus.

Abdomen about one and two-fifths times as broad as metathorax, quite stout to eighth segment, then sides converging to base of tube. Tube about three-fourths as long as head and one-third as wide at middle as long; sides straight, tapering slightly; terminal spines about as long as tube; spines on sides of abdomen pale, but quite prominent in reduced light. Segment one is concolorous with metathorax; three to five are clear, bright yellow; two, six, seven, and eight are yellowish brown, darkest on sides; nine and tube are darkest brown.

Described from four females.

Cotype.—Cat. No. 6333, U.S.N.M.

Male.—Length about five-sixths that of female; head and prothorax nearly as long as in female; relative lengths of antennal segments as follows:

$\frac{1}{10}$	$\frac{2}{11}$	$\frac{3}{16}$	$\frac{4}{14}$	$\frac{5}{13.8}$	$\frac{6}{11.8}$	$\frac{7}{10.5}$	$\frac{8}{9.5}$
----------------	----------------	----------------	----------------	------------------	------------------	------------------	-----------------

Abdomen only about four-fifths as long or as broad as in female and tapering more uniformly from base to tip.

Described from two specimens.

Cotype.—Cat. No. 6333, U.S.N.M.

Food plant.—Taken in turf.

Habitat.—Amherst, Massachusetts.

EURYTHRIPS, new genus.

Head as long or somewhat longer than wide, narrowed in front. Eyes small and vertex between them elevated. Antennæ fully twice as long as the head and thicker than in most species. Prothorax about two-thirds the length of the head. Fore tarsi with a small tooth, which is larger in the male than in the female. Wings usually reduced to short pads. Abdomen unusually large and heavy in proportion to the rest of the body. Males with a closely lying scale at the base of the tube.

The species *ampliventralis* is the type of this genus.

(*εuryς*, broad; *θρυψ*.)

The two species belonging to this genus may be separated by the breadth of the abdomen, which in *ampliventralis* (p. 202) is about one and two-thirds times as wide as the pterothorax, while in *osborni* (p. 203) it is only about one and one-fourth times as wide as the pterothorax.

EURYTHRIPS AMPLIVENTRALIS, new species.

Plate IX, figs. 99-101.

Female.—Length 1.08 mm. (1 to 1.20 mm.); width at middle of pterothorax 0.24 mm. (0.22 to 0.25 mm.). General color of head and legs clear yellow to brownish yellow; body shading posteriorly to dark brown beyond middle of abdomen.

Head slightly longer than wide, slightly narrowed in front, broadest at neck; cheeks diverging gradually behind the eyes; vertex drawn out into a hump between and in front of the eyes; post-ocular bristles quite long; head clear, brownish yellow with some red hypodermal pigment on vertex. Eyes extremely small and composed of but very few large facets, slightly protruding, oval in outline, black; ocelli wanting. Mouth cone short and blunt; labrum not constricted beyond middle. Antennæ approximate, large, and heavy, fully twice the length of the head, with peculiar, semicircular, shelf-like support visible on outer side at base; relative lengths of segments as follows:

<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>
9.2	10.4	14.8	13.5	12.8	11.9	9.5	6.4

Segment one is broadest, cylindrical, and following segments decrease gradually in diameter; three is clavate, four to seven each barrel-shaped, with a short stalk. Antennal segments shade gradually from concolorous with head at base to very dark brown at tip; spines and sense cones very long, slender, and quite prominent.

Prothorax quite variable in length, but averaging slightly more than two-thirds as long as head; width also unusually variable, but averaging twice its length and equal to width of pterothorax. Anterior marginal spines wanting; others present, moderately long, blunt, but not knobbed. Pterothorax very small, rather shorter than prothorax and usually slightly narrower. Wings reduced to mere pads. Fore and middle legs rather short and thick, but hind legs quite long and slender; fore femora but slightly thickened and tarsi armed with a tiny tooth. Legs concolorous with head; femora shaded somewhat with brown, but without hypodermal pigment.

Abdomen exceedingly large and heavy, about one and two-thirds times as broad as pterothorax; posterior half rounding up to base of tube. Tube fully two-thirds as long as head and almost one-half as broad at middle as it is long; sides straight and tapering evenly; terminal hairs slightly shorter than tube; spines on sides of abdomen quite long and prominent.

Prothorax concolorous with head, but much more suffused with irregular, bright red hypodermal pigmentation. (Seen by reflected light on white background.) Pterothorax and base of abdomen more shaded with brown, and the latter becoming darker toward tip, where it is dark brown or almost black. Pterothorax, and sides of abdomen especially, thickly marked with bright red hypodermal pigment.

Described from five females.

Cotype.—Cat. No. 6334, U.S.N.M.

Male unknown.

Food plant.—Taken in turf in fall.

Habitat.—Amherst, Massachusetts.

EURYTHRIPS OSBORN, new species.

Plate X, figs. 102, 103.

Female.—Length 1.12 mm. (1 to 1.22 mm.); width of mesothorax 0.27 mm. (0.25 to 0.30 mm.). General color light yellowish brown to dark brown; head and legs yellow.

Head approximately as long as wide, narrowed in front; the antennæ standing upon a triangular projection between the eyes; head enlarged quite abruptly behind the eyes; cheeks not converging posteriorly. Eyes very small, depressed, finely faceted, almost oval in outline;

black; ocelli present, small, frequently more or less hidden by irregular dark-red local pigmentation, placed well forward upon an elevation between the eyes; postocular bristles quite long. Mouth cone short and blunt; labrum not constricted abruptly. Antennæ very large and long, fully two and one-half times as long as head, with a semicircular, shelf-like support below bases; bases approximate; elevation between them extending half the height of first segments; relative lengths of segments as follows:

1	2	3	4	5	6	7	8
8.3	10.5	15.3	14.2	14.2	11.9	10.	9.9

Segment one large and cylindrical; two cup-shaped; three very slender at base, clavate; four to seven also slender at bases, decreasing gradually in diameter and length of stalk; eight enlarging to one-third its length and then tapering to a sharp point. Color shading gradually from concolorous with head at base to dark brown at tip. Spines and sense cones long, slender, and quite conspicuous. Head clear, pale yellow to brownish yellow.

Prothorax and pterothorax (in short-winged specimens) along dorsal line, each approximately as long as head; width of prothorax across coxæ nearly twice its length, its sides indented considerably above them. Anterior marginal spines wanting; others present as usual (at angles, mid-lateral and posterior marginal) long, slender, and blunt. Mesothorax approximately as broad as prothorax; in long-winged specimens about one-fourth longer than in short-winged, and also slightly fuller. Legs short and moderately stout; fore femora but slightly enlarged and tarsi armed with a small tooth; one long, erect, knobbed spine upon the back of each femur. Legs yellow; femora shaded with brown; in darker specimens femora more strongly shaded.

Abdomen large and heavy; fore angles abrupt; about one-half as wide as long; nearly cylindrical to seventh segment, then sides curve roundly to base of tube. Tube as long or slightly longer than head, about one-third as broad in middle as long, more slender in outer than in basal half; terminal spines only about two-thirds as long as tube; those on sides of abdomen quite long and prominent, knobbed.

Thorax and abdomen uniform in color, abruptly darker than head and legs, ranging from yellow-brown to dark brown, with considerable dark red, irregular, hypodermal pigmentation.

Described from ten females, eight long and two short winged.

Cotype.—Cat. No. 6335, U.S.N.M.

Male.—Males about six-sevenths as large as females. Relative lengths of antennal segments as follows:

1	2	3	4	5	6	7	8
8	10	12.6	12	12	10.2	8.6	8.6

The prothorax is a little wider than the mesothorax. Fore femora

considerably enlarged and tooth upon tarsus quite stout. Abdomen more slender than in females and tapering more gradually.

Described from five males, all short winged.

Cotype.—Cat. No. 6335, U.S.N.M.

Food plants.—Grasses.

Habitat.—Amherst, Massachusetts.

This species is named for Prof. Herbert Osborn, who has for many years shown considerable interest in the study of these tiny insects.

Genus CRYPTOTHRIPS Uzel.

Head cylindrical, fully one and one-half times as long as wide. Eyes large and prominent. Vertex strongly elevated and bearing the anterior ocellus at its extremity. Mouth cone about as long as its breadth at base and reaching about two-thirds across the prosternum; labrum blunt. Prothorax about as long as width of head. Legs slender; fore femora but slightly enlarged; fore tarsi unarmed. Wings present, slightly narrowed in middle. Male with a scale at base of tube.

I find only one species belonging to this genus, *aspersus*.

CRYPTOTHRIPS ASPERSUS, new species.

Plate X, figs. 104-106.

Female.—Length 1.68 mm. (1.45 to 2 mm.); width of mesothorax 0.32 mm. (0.28 to 0.36 mm.). General color yellowish brown to brown-black; body and legs considerably marked with irregular, dark-purplish, hypodermal pigmentation.

Head cylindrical, one and one-half times as long as wide, about as wide as length of prothorax; cheeks almost straight and nearly parallel, set with a few minute, slender spines; postocular bristles short; surface of head finely cross-striated. Eyes quite large, finely faceted, very slightly protruding, dark-purplish red with pale yellowish inner margins; ocelli present, small and inconspicuous, frequently concealed by local hypodermal pigmentation, situated far forward; posterior ocelli close to margins of eyes, front one on apex of prolonged vertex of the head. Mouth cone rather short, reaching only to middle of prosternum; maxillary palpi long and slender; sides of labrum straight, its point blunt. Antennæ inserted below vertex, approximate at base, slightly more than one and one-half times as long as the head, quite slender; relative lengths of segments as follows:

1	2	3	4	5	6	7	8
7.5	13	18.2	17.8	13.6	12.1	11.6	8

Segments one and two concolorous with head; three pale yellow; rest of antenna shading gradually to dark brown at tip, except bases of four and five, which are pale yellow; spines and sense cones short and inconspicuous.

Prothorax small, scarcely two-thirds as long as head. One spine at each posterior angle alone prominent; those at fore angles smaller than the anterior marginals; all indistinct; midlaterals wanting; posterior marginals small and not visible except on lightest specimens with careful focusing. Pterothorax approximately as wide as abdomen; its sides nearly straight and parallel. Wings present; hind fringe of fore wing double for five or six hairs near tip. Legs long and slender; fore coxæ projecting strongly; fore femora scarcely thickened and tarsi unarmed; one spine near base of each femur below much longer than others on legs and longest on fore femora; legs concolorous with body.

Abdomen long and slender, cylindrical to about seventh segment, about twice as wide as head, from seventh segment tapering quite gradually to tube. Tube short, only one half as long as head; its sides straight and converging slightly; width at middle about one-third width of head; terminal hairs about as long as tube. Spines at sides of abdomen slender, pale, and not very prominent; segments usually overlapping considerably; sides darkest in color.

Described from eight females.

Cotype.—Cat. No. 6336, U.S.N.M.

Male.—Male about five-sixths as large as female, though antennæ are of about same size in both sexes; relative lengths of segments as follows:

1	2	3	4	5	6	7	8
8	12	16.5	16	13	12.5	11	8

Abdomen much smaller than in female and tapering gradually from base to tip.

Described from one specimen.

Food plant.—Grape.

Habitat.—Amherst, Massachusetts.

Genus IDOLOTHRIPS Haliday."

Anterior ocellus remote from the base of the antennæ. Proboscis reaching the base of the prosternum; labial palpi papiliform; vein one of the fore wings shortened by one-half or abbreviated. Head very long, rounded; abdomen hollowed out. Antennæ slender, three or four times as long as the thorax; prothorax unequally tuberculated; metatarsi unarmed. Size large, marked with three or more lines.

In this genus I find only the species *coniferarum*.

IDOLOTHRIPS CONIFERARUM Pergande.

Plate X, figs. 107-110.

Idolothrips coniferarum PERGANDÉ, Entom. News, VII, 1896, pp. 63-64.

Idolothrips coniferarum TRYBOM, Festschrift für Lilljeborg, 1896, p. 218.

"This generic description is translated from Haliday's original description.

Female.—Length about 4 mm. (3.34 to 4.26 mm.); breadth of mesothorax 0.55 mm. (0.50 to 0.60 mm.). Color coal-black without markings.

Head long and cylindrical; proportional length more variable than in most species, but averaging about two and one-third times as long as wide; surface of head transversely finely striated; cheeks set with a number of short, stout spines; head broadened a trifle just before the neck-like constriction at the base; vertex produced into a very prominent, conical hump in front of the eyes and overreaching the insertion of the antennæ. Eyes large, finely faceted, bulging slightly, extending as far around on under side of head as on upper; ocelli small, widely separated, the anterior one occupying the extreme vertex; the posterior ones, nearly on a line with the middle of the eyes and close to their margins, are often invisible, unless in favorable light, owing to the opacity of the head. Mouth cone short and rounded. Antennæ approximate at base, inserted under the vertex, only about one and one-sixth times as long as the head, and slender; relative lengths of segments as follows:

1	2	3	4	5	6	7	8
$\frac{1}{12}$	$\frac{2}{19}$	$\frac{3}{38}$	$\frac{4}{32}$	$\frac{5}{26}$	$\frac{6}{17.5}$	$\frac{7}{13.8}$	$\frac{8}{15}$

Segment one concealed at base; three to five clavate; six to eight fusiform. Three mostly yellow (two-thirds); four nearly one-half, and five about one-third yellow; rest of antenna brown-black. Spines and sense cones light and inconspicuous, but the cones especially are long, slender, and acute; three apparently bears only one sense cone, and that is on outer side; six has but one, which is on inner side; four and five have four each.

Prothorax small, only about two-fifths as long as head; only the one long spine on the outer angle of each fore coxa is at all conspicuous. Pterothorax appears nearly square; sides straight and parallel; more than twice as wide as head. Wings present, but short as compared with great length of abdomen, not reaching beyond fifth or sixth segment, heavily fringed; hind fringe of fore wing double for about 26 hairs near tip. Legs short as compared with length of body; fore femora but slightly thickened and tarsi armed with a tiny tooth; legs set with a number of quite long, slender, black spines. Legs black, except fore tibiæ dark yellowish brown along middle of inside, and all tarsi dark brown.

Abdomen extremely long and slender, about two-thirds the length of the entire body and less than one-fourth as wide at base as it is long; tapers gradually from second segment to tube. Tube of female fully five-sixths as long as head and a little more than one-third the width of head; terminal hairs weak and only about two-thirds the length of the tube; spines on sides of abdomen short and weak.

Redescribed from four females.

Male.—Contrary to the usual rule, these two specimens are longer than the females, being 4.22 mm. (4.34 to 4.10 mm.). They are somewhat more slender, especially through the middle of abdomen. Heads about two and two-thirds times as long as wide; antennæ longer than in female, about one and one-fifth times as long as head; relative lengths of segments as follows:

1	2	3	4	5	6	7	8
$\frac{1}{14}$	$\frac{2}{20}$	$\frac{3}{42}$	$\frac{4}{34}$	$\frac{5}{29.5}$	$\frac{6}{21.5}$	$\frac{7}{14.5}$	$\frac{8}{15.5}$

Prothorax nearly one-half as long as the head; fore femora considerably thickened (almost as broad as the head) and each fore tarsus bearing an extremely stout tooth; fore tarsi and inside of tibiæ yellow.

Abdomen at second segment only two-elevenths as broad as long; tube three-fourths as long as head and very slender.

Male newly described from two specimens.

Food plants.—*Pinus iops*, *Juniperus virginiana*, and *Abies* sp.

Found on either green or dry branches in spring and early fall and hibernating under bark.

Habitat.—Near Washington, District of Columbia; Amherst, Massachusetts.

UNCLASSIFIED DESCRIPTIONS.

LIMOTHRIPI TRITICI (Fitch) Packard.

"The females alone are winged, the males being wingless and closely resembling the larvæ. The body of the female is smooth and shining, uniformly greenish yellow, with no other markings; the legs are a little paler toward the articulations. The antennæ are eight-jointed, slightly longer than the head; the two basal joints are the largest; the three succeeding joints equal, regularly ovate, the sixth a little longer than the fifth; seventh and eighth minute, seventh a little shorter than eighth, each joint bearing four large bristles. This species differs from the European *L. cerulium* in having but eight joints, the seventh and eighth being minute, and with no intermediate short one, as described in the European insect.

"The prothorax is square, the scutellum short, crescent-shaped, and the abdomen is long and narrow, smooth and shining, ten-jointed. Length, four one-hundredths of an inch, or less than half a line.

"The larva (fig. 2) is entirely greenish yellow, the head and prothorax of the same color as the rest of the body. The eyes are reddish. The feet and antennæ are whitish, not annulated, as in *L. cerulium*. The feet (tarsi) consist of but a single joint ending in a point.

"The male differs from the larva in having two-jointed feet (tarsi) and shorter antennæ, those of the larva being four-jointed. The second joint is entirely barrel-shaped, with two ridges or lines surrounding the third and fourth joints long, ovate, the third being a lit-

tle larger than the fourth, and with about twelve transverse lines, there being about eight on the fourth joint, from the end of which projects a remarkable tubercle, as seen in the figure. The fifth joint is square at the end, with about eleven transverse lines, and three or four stout hairs externally; sixth joint minute and spherical, while the seventh is three times as long as the sixth, and is finely striated, and with four unequal stout hairs. It is just twice the length of the female, measuring 0.08 inch."

THRIPS TRIFASCIATUS Ashmead.

"*Female*.—Length 0.8 mm. Light brown; eyes strongly faceted, purplish-brown in certain lights; three basal segments of the abdomen above, dark brown; segments 4, 5, and 6 white; apical segments light brown, the sutures dusky; legs, except hind femora toward tips, white; wings linear, strongly fringed, without nerves, the ground color brown or fuscous, with three transverse white bands, i. e., the front wings have a white band at base, another at about two-thirds their length, and with the apices white.

"*Habitat*.—Near Utica, Mississippi."

THRIPS SECTICORNIS Trybom.

I have been unable to see the description of this species which was published in Öfversigt af k. Vetenskaps-Akademiens. Förhandlingar, 1896, page 620.

PHLÆOTHRIPS MALI Fitch.

"This insect measures only six-hundredths of an inch in length and one-hundredth in width. It is polished and shining, and of a blackish purple color. Its antennæ, which are rather longer than the head and composed of eight nearly equal joints, have the third joint of a white color. The abdomen is concave on its upper side, and is furnished with a conical tube at its tip which has a few bristles projecting from its apex. The wings when folded are linear, silvery-white, and as long as the abdomen; they are pressed closely upon the back, spreading asunder at their bases, and appear like an elongated Y-shaped mark. Viewed from above, the head is of a square form, longer than wide. The first segment of the thorax is well separated from the second, is broadest at its base, and gradually tapers to its anterior end, where it is as wide as the head. The following segment is the broadest part of the body and square, with its length and breadth equal."

PHLÆOTHRIPS CARYÆ Fitch.

"This insect is 0.07 long, of a deep black color and highly polished. Its head is narrower than the thorax and nearly square. The third, fourth, and fifth joints of the antennæ are longer than the others, yellow, and slightly transparent; the last joint is shortest and but half as

thick as those which precede it. The abdomen is egg-shaped, with its tip drawn out into a tube thrice as long as it is thick, with four long bristles at its end, and the abdomen is furnished with bristles at each of its sutures. The wings do not reach the tip of the abdomen. They are white and slightly transparent and fringed with black hairs. In its larva state it has a more slender linear form with a dull greenish yellow head, a white thorax with a broad black band anteriorly, a pale red abdomen with a black band at its tip, and whitish legs."

FOSSIL THYSANOPTERA.

Tiny though they are, these insects are not unknown as fossils. The White River deposits are the only ones in this country from which they are yet known. Three species, representing as many genera, have been found there in Tertiary rocks, and have been described by Dr. S. H. Scudder (174, 336), whose descriptions of these insects follow. The last two genera are extinct. Of the genus *Melanothrips*, no living representative has as yet been found in this country, though a species of this genus is known in Europe.

MELANOTHRIPS EXTINCTA Scudder.

Melanothrips extincta SCUDDER, Bull. U. S. Geol. Geog. Surv. Terr., I, 1875, p. 221; Rept. U. S. Geol. Surv. Terr., XIII, 1890, p. 371.

"Head small, tapering; the only appendages visible are the antennæ; these are only sufficiently preserved to recognize that they are very long and slender, longer than the thorax. The thorax is rather small, quadrate; wings nearly as long as the body, fringed on the costal border as in *Palæothrips fossilis*. The abdomen is composed of only eight joints, but is very long and very tapering, fusiform, the last joint produced, as usual in the Physapods; the third joint is the broadest; of the wings only the costal border and a part of one of the longitudinal veins can be seen; there are no remains of legs.

"Length of body, 2.2 mm.; of antennæ, 0.8 mm.; of head, 0.14 mm.; of thorax, 0.5 mm.; of abdomen, 1.56 mm.; greatest breadth of abdomen, 0.5 mm.

"Chagrin Valley, White River, Colorado. One specimen, W. Denton."

Genus LITHADOTHRIPS Scudder.

Lithadotrips SCUDDER, Bull. U. S. Geol. Geog. Surv. Terr., I, 1875, p. 221; Rept. U. S. Geol. Surv. Terr., XIII, 1890, p. 372.

"Applied to *Melanothrips* Haliday. The head is large, broad, globose; the eyes exceedingly large, globose, each occupying on a superior view one-third of the head; the antennæ very slender, equal, as long as the thorax, the joints eight or nine in number, cylindrical, and becoming narrower toward their tips. The prothorax is no

larger than the head, of equal breadth with it, the whole thorax shaped as in Palæothrips. Only fragments of the wings remain, sufficient to render it probable that they agree well with the character of the group to which Melanothrips and Æolothrips belong. The legs resemble those of Palæothrips, but are slender and appear to be rather profusely supplied with hairs. The abdomen differs considerably in the two specimens referred to this genus. In one it is very broadly fusiform, the tip a little produced, nine joints visible, the apical furnished with a few hairs, and bluntly rounded at the tip; the other has the sides equal, the apex not at all produced, but very broadly rounded, only seven or eight joints vaguely definable.

"A single species is known."

LITHADOTHRIPS VETUSTA Scudder.

Lithadotrips vetusta SCUDDER, Bull. U. S. Geol. Geog. Surv. Terr., I, 1875, p. 222; Rept. U. S. Geol. Surv. Terr., XIII, 1890, p. 372.

"The specimens, both of which represent the upper surface of the body with fragments and vague impressions of the members, are too poorly preserved to add anything to the above description of their generic features, excepting the following measurements:

"*First specimen*.—Length of body 1.76 mm., of antennæ 0.6 mm., of thorax 0.6 mm., of abdomen 0.87 mm.; breadth of head 0.28 mm., of thorax 0.52 mm., of abdomen 0.56 mm.; length of fore femora, 0.37 mm. ?; breadth of same, 0.14 mm.; length of hind femora, 0.42 mm.; breadth of same, 0.13 mm.

"*Second specimen*.—Length of body 1.96 mm., of antennæ 0.76 mm., of thorax 0.56 mm., of abdomen 1.10 mm.; breadth of head 0.38 mm., of thorax 0.59 mm., of abdomen 0.59 mm.

"Fossil Canyon, White River, Utah. Two specimens, W. Denton."

Genus PALÆOTHRIPS Scudder.

Palæothrips SCUDDER, Bull. U. S. Geol. Geog. Surv. Terr., I, 1875, p. 222.

"This genus is allied to Æolothrips Haliday. The head is small, globose; eyes rounded, much smaller than in Lithadotrips; antennæ slender, fully as long as the thorax, not more than seven jointed, the joints cylindrical, subequal. Prothorax considerably larger than the head, the thorax as a whole very large, stout, and tumid; fore femora very stout, scarcely more than twice as long as broad; fore tibiæ also stout, a little longer than the femora; the other legs are moderately stout, long, reaching beyond the tip of the abdomen, with a few scattered, rather short, spinous hairs; the hind tarsi three jointed, the last joint smaller than the others, and altogether two-sevenths the length of the tibiæ. Fore wings unusually broad, broadest apically, where their breadth more than equals one-fourth of their entire length, provided with two longitudinal veins, dividing the disk into three nearly

equal portions, connected in the middle by a cross vein, and with either border by other cross veins at about one-third and two-thirds of the distance from the base to the tip of the wing; the wing is heavily fringed, especially along the hind border. Hind wings veinless, nearly as long, and at the tip nearly as broad, as the fore wings. Abdomen nine jointed, half as long again as the thorax, rather tumid, scarcely or not at all produced apically."

PALÆOTHRIPS FOSSILIS Scudder.

Palæothrips fossilis SCUDDER, Bull. U. S. Geol. Geog. Surv. Terr., I, 1875, pp. 222-223.—ZITTEL, Handb. d. Palæontology, I, Pt. 2, 1885, p. 784, fig. 999; Rept. U. S. Geol. Surv. Terr., XIII, 1890, pp. 373-374.

"Head small, tapering a little in front, where, however, it is broadly rounded. The antennæ are certainly seven jointed, and none of the apical joints show any indication of being connate, the last joint being of the same length as the two preceding it, tapering, and bluntly pointed; none of the joints show any enlargement in the middle, but the middle joints are slightly larger at the distal extremity than at the base; they appear to be destitute of hairs. The prothorax is subquadrate, a little broader than long, with rounded sides; the fore femora are unusually stout, as long as the width of the prothorax. The longitudinal veins of the fore wings approach each other somewhat abruptly in the middle, where they are united by a cross vein, and at the tip of the wing they curve away from each other; the two cross veins on the lower third of the wing are, respectively, slightly farther from the base of the wing than the corresponding veins of the upper third; the fringe on the posterior border is largest near the tip of the wing, where the hairs are about three times as long as those on the costal border. The first hind tarsal joint is scarcely longer than broad, cylindrical; the second of about the same length, but decidedly broader at apex than at the base; the apical joint is nearly globular, smallest at base, as large in the middle as the base of the other joints. There are a few hairs at the tip of the abdomen and a few short ones on the hind tibiæ; the apical ones stouter than the others, resembling spines; but the insect appears to have been unusually destitute of hairs, excepting on the wings, where not only the edges but also all the veins are fringed.

"Length of body 1.6 to 1.8 mm.; of antennæ 0.58 mm.; of fore femora 0.32 mm.; breadth of same 0.14; length of fore tibiæ 0.32 mm.; of hind femora 0.38 mm.; breadth of same 0.11 mm.; length of hind tibiæ 0.42 mm.; of hind tarsi 0.12 mm.; of fore wings 1.4 mm.; of hind wings 1.27 mm.; greatest breadth of fore wings 0.37 mm.; length of prothorax 0.16 mm.; breadth of same 0.32 mm.; length of whole thorax 0.64 mm.; of abdomen 0.92 mm.; greatest breadth of the same 0.37 mm.

"Fossil Clayon, White River, Utah. W. Denton."

GENERAL CONSIDERATIONS

As has been shown in Jordan's conclusion in regard to the systematic position of this group (see p. 82), Thysanoptera have branched off from the line of the Orthoptera-Hemiptera and resemble the Homoptera more closely than they do any other group.

Starting with a given form which we may call Prothysanopteron, I believe that changes in the degree of development of any of its organs must be correlated with changes in its habits and environment. What was Prothysanopteron like? Judging from its line of phyllogeny, it must certainly have been an active running and flying insect, having elongated mouthparts which were probably becoming suctorial in function and bearing near the other extremity of the body a saw-like ovipositor. Having these organs which would be concerned in the chief relations of its life to its environment—nutrition, locomotion, and reproduction—what can we infer as to the habits of that primitive insect? It fed externally upon the juicy parts of plants, probably puncturing them with its elongated mouthparts and sucking up the exuding juices. It flew from flower to flower or tree and ran about actively thereupon. In the tissue of its food plants it deposited its eggs, cutting the necessary slits for them with its saw-like ovipositor. Its legs, used chiefly in running or crawling, would present few, if any, modifications, while its wings, though surely slender, were probably broad as compared with those found in the order to-day, and the hairs which happened to stand along their edges had begun to elongate so as to compensate, in some degree, for the narrowness of the membranes. With such an insect and such habits as this hypothesis suggests, if we can name reasonable changes in habits which, acting in accordance with the laws of Nature as we know them to be acting to-day, will produce the various forms of insects which we now include in this order, we feel that our hypothesis can be as well sustained as any such hypothesis with reference to primitive forms is capable of being.

If some of the descendants of our external-feeding Prothysanopteron in their struggle for existence should, in the course of numerous generations, acquire a habit of feeding in some well-protected part of the plant, e. g., inside the closely rolled central leaves of *Tucca filamentosa*, where they would be comparatively safe from the attacks of their enemies (a change of habit easily produced by natural selection), then, this environment being favorable, they would no longer find as frequent or as urgent use for their wings and legs as had their ancestors, and they would be favored by remaining in a very restricted place. As a result, wings would degenerate from disuse, and the movements of the insects upon their feet would become slower. Wings might, and probably would, be a distinct disadvantage in such a restricted habitat, so that many influences would tend toward their reduction,

which, however, could not be complete without entailing a decided disadvantage to the species by hindering its spread to other food plants. Nature has established her line of equilibrium somewhere between the two extremes, and we have a majority of short-winged individuals favored by the absence of long wings, but yet in nearly every species will be preserved in some sex, generation, or individuals fully developed wings to assist in the spreading of the species. This line of "balance" will be affected by nearly every habit of the species, so that we may naturally expect to find it in different places in species having different habits, and such is indeed the case. (See p. 105.)

Such a change of habit from frequenting an exposed to a protected feeding ground would affect other organs than the wings. There would no longer be any need of embedding the eggs for protection, and should the atmosphere prove sufficiently moist, they would undoubtedly develop though laid upon the surface of the leaf or stem. This would save much of the energy of oviposition, and in the course of time the practice of embedding the eggs would cease altogether. Having now no use for the ovipositor, that, too, would degenerate from disuse till, at most, a mere vestige would remain of this originally well-developed organ. Some such course of development I believe to have taken place in the Phlæothripidæ, and the chitinous rod now found on the underside of the ninth abdominal segment just in front of the sexual opening seems best explainable as the remaining vestige of the former ovipositor. (See Plate X, fig. 115.) As the ovipositor became weaker and weaker other changes correlated to this must have been in progress. The sheath which had contained the ovipositor, being no longer needed, would naturally become closed up. The ventral plates which had previously disappeared to provide room for the sheath would not again develop, but the edges of the dorsal plates closing around still further would meet on the ventral line forming the tube of the Tubulifera. At the same time the sexual opening seems to have moved backward till it reached the hind part of the ninth segment, where it is now found.

Other modifications of the Prothysanopteron, found in the Tubulifera (mainly), may logically be traced to this one change of habit. I refer to the trapezoidal form of the prothorax, the enlargement of the fore legs, and the development of a tooth upon the fore tarsus which thereby has lost one segment in a large number of forms, also the flattened character of the body, and possibly its elongation.

In regard to the modifications of the prothorax and the fore pair of legs, it is very evident that they may all be related to the one simple change of habit in regard to the place of feeding, which has been assumed. Naturally considerable effort would frequently, perhaps usually, be required to drag their bodies through such narrow places as those in which they lived. Any variation in the line of a more

powerful development of the muscles of the fore legs or of any modification of the tarsus which would tend to give a firmer hold in crawling, being favorable to the insect, would be preserved by natural selection, and thus in the course of many generations the tarsal tooth and the powerful, thickened femora of most Tubulifera would be developed. There would also be a correlative broadening and flattening of the prothorax, which would necessarily result in pushing farther apart the fore coxæ, which are attached to its hind angles. The logical result of these changes is the trapezoidal form of the prothorax always found in those species having such thickened femora and well-developed tarsal hooks.

The elongation and flattening of the body are doubtless referable in some degree to the same change in the conditions of external life, for such a changed form would certainly have been favorable to its possessors, and we are surely safe in assuming that the favorable changes are the ones which have been preserved, while the unfavorable ones have been eliminated. We do not presume to say that all the descendants of Prothysanopteron followed this suggested line of change; some of them certainly may have done so. Neither do we presume that all the descendants of those which did follow some such line of development would continue in an even similar environment till all the modifications which have been named had been accomplished. We have just as much reason to expect a change of environment anywhere along the phylogenetic line as at its beginning, and such changes certainly must have taken place. What would be the result if this were the case? Different environments acting upon different subjects, or even upon like subjects, would favor entirely different variations. Structures which had become developed during the changes subsequent to Prothysanopteron might be lost, but those that had been lost could never again be developed in their original form; e. g., tarsal teeth and thickened femora might develop and then disappear, but an ovipositor of the original type would never again be found in the Tubulifera. We would expect then that the descendants of Protubuliferan would vary in habits, habitat, form, and life rather than in the tubular nature of the terminal segment of the body. Such is indeed the case, and so while there do take place great modifications of each organ, the presence of the tube is constant. We feel justified in concluding that the family Phleothripidæ has now diverged far more widely from Prothysanopteron than has either of the families of the Terebrantia.

The two families constituting the suborder Terebrantia resemble each other quite closely in many respects. We find between them no such marked points of difference as we do between each of them and the Phleothripidæ. The principal differences which do exist are mainly various modifications of the same organ, and the most impor-

tant structures which we must notice are the antennæ, wings, and ovipositor. What are the chief points of difference that we find in the structure of these organs? Only a modification in the structure of each organ has taken place. In *Eolothripidæ* we find always nine segmented antennæ, comparatively broad wings, which are rounded at their extremities, and have, in the fore wing, the fore fringe and the spines along its veins very weakly developed, a strong ring vein, two longitudinal veins, and four or five cross veins, and finally a strongly developed ovipositor, which curves upward toward the tip of the abdomen. In *Thripidæ* we find antennæ with from six to eight segments, wings which are nearly always slender and quite sharply pointed at their tips; that in the fore wing the fore fringe and numerous spines along its veins are nearly always well developed, two (sometimes only one) longitudinal veins are present, the ring vein is rarely strongly developed, cross veins are absent or but slight traces of them occasionally appear, the ovipositor is moderately well developed in most cases, but sometimes is small, weak, and functionless, though it is always plainly present and curves downward away from the tip of the abdomen.

Between these two families we shall find it much more difficult to decide just what influences may have favored the development of the differences noted. Certainly many influences were concerned, and they could not have been of such a nature as to favor such radical changes as have resulted in the development of the *Tubulifera*. Rather than attempt to outline these varied influences and their probable results, we prefer, in this case, to base our conclusions upon the general tendencies which now appear to be acting, and which we may reasonably assume to have been acting in the same way during much, perhaps all, of the past history of this suborder.

We have shown that *Phlæothripidæ* have diverged more widely from *Prothysanopteron* than have any other members of the order. A comparison of the antennæ in the three families will aid us in determining the order in which the families must be arranged. In the *Phlæothripidæ* these organs are always eight segmented. The intermediate segments are, as a rule, much thicker in the middle than at the ends, and are sometimes rounded. Stout spines are borne around the apical thirds of segments two to six, inclusive, and more slender spines are more generally distributed over the last two segments. A whorl of small spines stands also around the first third of each segment from three to six, inclusive, and simple, stout, specialized sense cones are borne at about the outer third of these segments in most cases. The antennæ of *Thripidæ* consist of from six to eight segments, of which the intermediate ones are always considerably thicker in the middle than at their ends. Stout spines are usually present around the apical ends of segments two to five inclusive. More slender spines

are generally distributed over segments six, seven, and eight, and from three to five whorls of small spines are often discernible around the middle half of each intermediate segment. Sense cones are found upon segments three to six, inclusive; in some cases these are all simple, though in the majority those upon segments three and four are double or crescentic in form. The antennæ of *Æolothripidæ* have always nine segments, of which the intermediate ones are always much elongated and regularly cylindrical in form. Stout spines are found only around segment two, while the remaining segments, except the basal, are thickly set with small spines, which are irregularly, but generally distributed. Of these last two types of antenna, that of *Thripidæ* unquestionably approaches more closely to that of *Phlæothripidæ*. Granting that the latter exhibits the extreme degree of divergence from the original type, we must place *Thripidæ* next, and this leaves the antenna of *Æolothripidæ* as resembling most closely that of *Prothysanopteron*.

If we examine the wings in like manner, we shall find that both pairs of those of *Phlæothripidæ* are similar in form, long, slender, and rounded at their ends. Ring vein and cross veins have entirely disappeared. Each wing has only one longitudinal vein, which is median and though quite strong at its base usually disappears before the middle of the wing. The fringes upon both margins are equally well developed and quite similar in all respects. The membrane of the wing is smooth and the veins are not set with spines except for about three, which usually stand near the base of the vein in the fore wing. *Thripidæ* have wings which differ in many regards from those of *Phlæothripidæ* just described. The fore and hind wings are dissimilar in many respects. They are both, however, long, very slender (except the fore wing of *Parthenothrips*), and sharply pointed at the tips. The fore wing is always somewhat stronger than the hind wing and has more veins and heavier fringes. There are usually present in it two fully developed longitudinal veins (sometimes only one), and these disappear before reaching the end of the wing. The ring vein, though very strong in the one species of *Parthenothrips*, is weakly developed in most species and in some is hardly distinguishable. Traces of cross veins can sometimes be seen, but they are never strongly developed except the one between the two longitudinal veins at the first third of the wing. While entirely absent (with the exception named as strongly developed) in most species, there may occasionally appear individuals having wings which show traces of cross veins, and it is very significant that these always occur at just the same positions in the wing as are occupied by the cross veins of *Æolothripidæ*, which will be more fully described in connection with that family. The hind wing has one longitudinal vein which is median, but no ring or cross veins are present. Fringes usually occur upon

both margins of both wings, but are different upon the two margins, the fore fringe being single, shorter, and usually stouter than the hind one. The veins of the fore wing alone bear more or less strongly developed spines which upon the costa may even take the place of the fringe. The membranes of both wings are thickly set with very minute, microscopic spines. In *Æolothripidæ* we find wings which are long, comparatively broad, and rounded at their extremities. Here also the fore and hind wings are dissimilar in many respects, the fore wing being stronger and far more heavily veined. The fore wing has always a strongly developed ring vein,^a two longitudinal veins which extend throughout the wing and unite with the ring vein on each side of the tip, and four or five well-developed cross veins situated as described on p. 129. The hind wings have no fully developed longitudinal vein and no trace of cross or ring veins. No fringe is developed on the front margin of the fore wing and only a very short, weak fringe is here present upon the hind wing. The veins of the fore wing bear only short spines and the membranes of both wings are thickly set with small spines which, though minute, are larger than the similar spines in *Thripidæ*.

Comparing now these three types of wing point by point, and balancing the weight of evidence, we are led to the conclusion that *Æolothripidæ* and *Phlæothripidæ* stand at the extremes in respect also to their wings, with *Thripidæ* somewhere between them but nearer to the former than to the latter group. The strong, constantly developed ring vein of *Æolothripidæ* has become much weaker or entirely disappeared among *Thripidæ*, while in the widely divergent *Phlæothripidæ* no trace of it is found. Cross veins are also disappearing in *Thripidæ*, and their occasional presence in much the same position in the wing as in *Æolothripidæ* suggests the idea that they are undergoing degeneration and that this process has gone farther in some species than in others. In *Æolothripidæ* the longitudinal veins join the ring vein near the tip, in *Thripidæ* they do not reach this point but taper out and disappear before the tip, while in *Phlæothripidæ* they rarely reach beyond the middle of the wing. The microscopic spines upon the membranes and the comparative development of the fore fringes both point to this same relation of the families. In only one character do the wings of the extreme groups closely resemble each other—this is in the broadly rounded tips. The *Phlæothripidæ* being, as we have seen, the most widely divergent group, we must conclude that, so far as wings are concerned, those of *Æolothripidæ* resemble most closely the wings of *Prothysanopteron*.

In regard to the ovipositor but little will need to be said. It is always found more strongly developed in *Æolothripidæ* than in *Thrip-*

^a This heavy ring vein is a most remarkable character and, so far as the writer can learn, nothing like it is found in any other order of insects.

idæ, while in Phlæothripidæ it is entirely wanting. Moreover, there exists in Thripidæ a wide variation in the degree of its development, as has already been shown. So in this respect, also, we must place our three families in the same relation to each other, and if Prothysanopteron possessed an ovipositor, as we can not doubt from its phylogeny must have been the case, the well-developed organ found in Æolothripidæ must very probably approach most closely to the primitive form.

Summarizing the conclusions which we have now reached, we find, first, that the Tubulifera (Phlæothripidæ) have diverged more widely from Prothysanopteron than have either of the families of the Terebrantia. Second, a comparative consideration of antennæ, wings, and ovipositor shows that Æolothripidæ and Phlæothripidæ present the extreme types of these structures found in the order. Therefore we conclude that the Æolothripidæ most nearly preserve the characters present in the Prothysanopteron ancestor of this order. From this it appears that the descendants of Prothysanopteron early divided into two main groups, one of which diverged widely from the original form and has developed the Tubulifera of to-day. The other of these groups continued nearly along the original line, but in time it divided again and a group (Thripidæ) branched off, taking in some respects the direction of Phlæothripidæ, while in the majority of characters it followed a line of its own. The group which still continued most nearly in the original direction includes the insects which we now place in the family Æolothripidæ.

BIBLIOGRAPHY.^a

- * 1. BONANNI, Ph., *Micrographia Curiosa*, 1691, pp. 52, 53, fig. 38.
- * 2. DE GEER, C., *Abhandl. d. Schwed. Akad.*, VI, 1744, pp. 3-9; *Vetensk. Acad. Handl.*, V, 1744, pp. 1-9, pl. I, fig. 4; *Deutsch Uebers.*, VI, pp. 3-9, fig.; *Latein Analecta Transalpina*, I, 1751, pp. 277-281.
3. LINNÆUS, C., *Systema Naturæ*, 4th ed., 1744, p. 93.
- * 4. LINNÆUS, C., *Fauna Svecica*, 1746, p. 220.
5. LINNÆUS, C., *Syst. Nat.*, 10th ed., I, 1758, p. 457; 12th ed., I, Pt. 2, 1767, p. 743; 13th ed., I, Pt. 2, 1767, p. 743.
6. LINNÆUS C., *Fauna Svecica*, 1761, pp. 266, 267.
- * 7. SULZER, J. H., *Die Kennzeichen d. Insecten*, 1761, pp. 83-85.
8. SCOPOLI, J. A., *Entomologia Carniolica*, 1763, p. 141.
- * 9. GLEICHEN, F. F. W., *Das neueste aus dem Reiche der Pflanzen*, 1764, pp. 13, 14, pl. XVI, figs. 6, 7.
- * 10. GEOFFROY, E. L., *Histoire abrégée des Insectes*, I, 1764, pp. 383-386, pl. VII, fig. 6.
11. DE GEER, C., *Mémoires pour servir, à l'Histoire des Insectes*, III, 1773, pp. 1-18, pl. I, figs. 1-13.
12. FABRICIUS, J. C., *Syst. Entomologie*, 1775, p. 745.
13. MÜLLER, O. F., *Zoologie danica Predromus*, 1776, p. 96.
14. FABRICIUS, J. C., *Genera Insectorum*, 1776, pp. 304-305.
- * 15. SULZER, J. II., *Abgekürzte Geschichte der Insecten*, 1776, p. 112.
- * 16. SCHRANK, F., *Schrank Beiträge*, 1776, pp. 31-33, fig.
- * 17. GOEZE, J. A. E., *Entomologische Beyträge*, 2d ed., 1777, pp. 346-351.
- * 18. SCHÄFFER, J. Ch., *Elementa Entomologica*, 3d ed., 1780, p. 127.
- * 19. GOEZE, J. A. E., *Abhandl. z. Geschichte d. Insecten*, III, 1780, pp. 1-11.
- * 20. SCHRANK F., *Enumer. Insectorum Austriæ indigenorum*, 1781, p. 297.
21. FABRICIUS, J. C., *Species Insectorum*, II, 1781, pp. 396, 397.
22. BARBUT, J., *Les Genres des Insectes de Linné*, 1781, pp. 157-159, pl. IX.
23. FABRICIUS, J. C., *Mantissa Insectorum*, II, 1781, p. 320.
24. MARTYN, W. F., *A New Dictionary of Natural History*, 1785.
25. GIMELIN, J. F., *Caroli a' Linné Syst. Nature*, 13th ed., I, Pt. 4, 1788, pp. 2222-2224.
- * 26. DE VILLERS, C., *Caroli Linnæi Entomologia*, I, 1789, pp. 564-567.
- * 27. BERKENHOUT, J., *Synopsis Nat. Hist. of Gt. Britain and Ireland*, 1789, pp. 122, 123.
- * 28. BJERKANDER, C., *Vetensk. Acad. nya. Handl.*, XI, 1790, pp. 226-229; *Deutsch Uebers.*, II, 1792, pp. 213-216.
29. ——— *A new Syst. of Nat. Hist.*, III, 1792, p. 447.
30. FABRICIUS, J. C., *Entomol. Systematica*, IV, 1794, pp. 228, 229.
31. MARSHAM, T., *Trans. Linn. Soc. Lond.*, III, 1797, pp. 242-251, pl. I.
32. KIRBY, Wm., *Trans. Linn. Soc. Lond.*, III, 1797, pp. 246-249.
33. MARKWICK, W., *Trans. Linn. Soc. Lond.*, III, 1797, p. 246.
34. MARSHAM, T., *Trans. Linn. Soc. Lond.*, IV, 1798, pp. 224-229.
35. KIRBY, Wm., *Trans. Linn. Soc. Lond.*, IV, 1798, pp. 230-239.

^aI have not been able to see the references marked with an *.—W. E. HINDS.

36. BLUMENBACH, J. F., *Handb. d. Naturgeschichte*, 6th ed., 1799, p. 344.
- *37. STEWART, *Elements of Nat. Hist.*, II, 1802, p. 114.
38. FABRICIUS, J. C., *Systema Rhyngotorum*, 1803, pp. 312-314.
39. BECHSTEIN and SCHARFENBERG, *Naturgesch. d. Schädli. Fortinsekten*, 1804, Pt. 1, pp. 290-292.
40. PANZERI, G. W. F., *Schaefferi Iconum Insectorum*, new ed., 1804, p. 213, pl. CCLXX, fig. 4, a, b.
41. TURTON, Wm., *A General System of Nature*, (Transl. from Gmelin's ed. of *Syst. Nat.*), II, 1806, pp. 8. 716-717.
- *42. SHAW, G., *General Zoology*, VI, 1806, p. 199, pl. LXIII.
43. LATREILLE, P. A., *Genera Crustaceorum et Insectorum*, III, 1806, pp. 170-172.
- *44. DUMÉRIL, C., *Zoologie analytique ou Méthode nat. de Classific. des Animaux*, 1806, pp. 261, 268, 269.
- *45. VASSALLI EANDI, A. M., *Mem. Acad. Torin*, XVI, 1809, p. 76.
46. FALLEN, C. F., *Spec. nov. Hemiptera*, 1814, pp. 3-24.
47. LEACH, W. E., Amer. ed., *New Edinburgh Encyclopaedia*, VIII₂, 1816, p. 715.
48. SAMOUELLE, G., *Entomologists Compendium*, 1819, p. 232, pl. v, fig. 12.
- *49. WOOD, Wm., *Illustrations of Linn. Genera of Insects*, 1831.
50. LATREILLE, P. A., *Fam. nat. du Regne Animal*, 1825, p. 429.
51. STARK, J., *Elements of Natural History*, II, 1828, p. 326.
- *52. LOWELL, J., *Mass. Agri. Repos. and Journ.*, X, 1828, pp. 156-159.
53. STRAUS-DÜRKHEIM, *Consid. Générales sur l'Anat. Comp. des Animaux Articulés*, 1828.
54. LATREILLE, P. A., *Cuvier, Regne Animal*, 2d ed., V, 1829, p. 226.
55. MAJOR, J., *Treatise on Insects*, 1829, pp. 87-90.
56. STEVENS, J. F., *A Systematic Catalogue of Brit. Ins.*, II, 1829, p. 363.
57. McMURTRIE, H., *Cuvier's Animal Kingdom*, Translated, IV, 1831, p. 49.
- *58. BOUCHÉ, P. F., *Naturgesch. d. schädli. u. nützli. Garten-Insecten*, 1833, p. 42.
59. BOUCHÉ, P. F., *Naturgesch. d. Insecten*, 1834, pp. 206-207.
- *60. PASSERINI, C., *Atti Acad. Georgof.*, XII, 1834, p. 7; XIII, 1835, p. 10; *Revue Zool.*, IV, 1841, p. 29; V, 1842, p. 368.
61. NEWMAN, E., *Entomological Magazine*, II, 1835, pp. 379, 426.
62. DENHAYN and EDWARDS, *Lamarck's Histoire nat. d. Animaux sans Vertebres*, 2d ed. IV, 1835, pp. 122, 123.
63. HALIDAY, A. H., *Entomological Magazine*, III, 1836, pp. 439-451.
64. LATREILLE, P. A., *Cuvier, Regne Animal*, 3d ed., III, 1836, p. 138.
65. HALIDAY, A. H., *Entomol. Magazine*, IV, 1837, pp. 144-146.
- *66. ERICHSON, W. F., *Archiv f. Naturgesch.*, III, Pt. 2, 1837, p. 332.
67. CURTIS, J., *Guide to Arrangement of Brit. Ins.*, 2d ed., 1837, pp. 2, 19, 220.
- *68. DAHLBOM, G., *Kort underrättelse om Skandinaviska Insekters almännare Skada och Nyttä*, 1837, p. 149.
69. BURMEISTER, H., *Handb. d. Entomologie*, II, 1838, pp. 404-418.
70. CURTIS, J., *British Entomology*, XVI, 1839, p. 748, pl.
- *71. BURMEISTER, H., *Genera Insectorum*, 1839.
72. SALACROUX, *New Eléments d'Histoire Naturelle*, II, 1839, p. 208.
73. VOIGT, F. S., *Cuvier, Das Thierreich*, V, 1839, p. 399.
- *74. DUPOUR, L., *Ann. Scienc. natur.*, 2d ser., Zool., XI, 1839, pp. 321-324.
- *75. WESTWOOD, J. O., *Introd. to Modern Classific. of Insects*, I, 1839, pp. 45, 46; II, 1840, pp. 1-5, fig. 57.
76. HANSSON and SHUCKARD, *History and Natural Arrangement of Insects*, 1840, pp. III, 154, 145-146.
77. ZENCKEN, W., *Insecta lapponica descripta*, 1840, pp. 312, 313.
- *78. ERICHSON, W. F., *Archiv f. Naturgesch.*, VI, Pt. 2, 1840, p. 324.
- *79. HANSON, W. M., *Rep't Ann. of Mass. in Rep't Zool. and Bot. Surv. Mass.*, 1841.

80. HARRIS, T. W., Rep't Ins. Mass. Inj. to Vegetation, 1st ed., 1841, pp. 18, 187, 444; reprinted as Treatise on Ins. Inj. to Veget., 2d ed., 1852, pp. 20, 234, 235; 3d ed., 1862; new ed. by Flint, 1883.
81. CURTIS, J., Gard. Chron., April, 1841, p. 228, fig., pp. 521, 569, 782.
82. HARRIS, T. W., Hovey's Mag. of Hort., VIII, 1842, pp. 247, 248.
- *83. TAMBRIN, F., Memoir sur le Thrips olivarius (Thrips de l'olivier) et sur les moyens de prevenir les ravages de cet Insect, VIII, 1842, p. 4.
84. GUERIN-MENEVILLE, F. E., Iconographie du Regne Animal de G. Cuvier (dated 1829-1838), III, 1843, pp. 377, 378, pl. 59, figs 13, 14.
85. AMYOT and SERVILLE, Hist. nat. d. Ins. Hemipteres, p. 9 and Appendice, 1843, pp. 637-646.
86. CURTIS, J., Gard. Chron., 1846, p. 564.
87. CURTIS, J., Journ. Roy. Agr'l Soc. Eng., VI, 1846, pp. 493-518, pl. II.
88. DOHRN and BUELOW, Stett. Ent. Zeit., VIII, 1847, pp. 377-381.
- *89. SCHAUM, H., Archiv f. Naturgesch., XV, Pt. 2, 1849, p. 315.
90. ———, Cuvier, Regne Animal, ed. by Masson, Texte, II, 1849?, pp. 71, 72; Atlas II, pl. xcix bis, fig. 3.
- *91. BLANCHARD, E., Zoologia, VI, 1851, pp. 143-152.
92. LEUNIS, J., Schul-Naturgeschichte, Pt. 1, Zool., 1851, pp. 203-205.
93. HEEGER, E., Sitzungsber. d. math.-naturw. Class d. kais. Akad. d. wiss., VIII, 1852, pp. 123-144, pl. x; IX, 1852, pp. 473-490, pl. vi.
94. HALIDAY, WALKER, List Homopterous Ins. in Coll. of Brit. Mus., Pt. 4, 1852, pp. 1094-1118, pls. vi, vii, viii.
- *95. HEEGER, E., Proc. Vienna Acad., IX, 1852.
- *96. DAHLBOM, G., Trans. Roy. Acad. Sweden, 1852?
- *97. SCHAUM, H., Archiv f. Naturgesch., XIX, Pt. 2, 1853, p. 285.
98. WESTWOOD, J. O., Proc. Ent. Soc. Lond., 1853, p. 78.
- *99. HEEGER, E., Sitzungsber. kais. Akad. Wissensch., XIV, 1854, pp. 365-373, 2 pls.
100. FITCH, A., Trans. N. Y. St. Agr'l Soc., XIV, 1854, pp. 806-808.
- *101. BREMI-WOLF, J. J., Abhandl. d. Zurich Gartenbau-Gesell., III, 1854, pp. 260-261.
- *102. NORDLINGER, II., Die kleiner Feinde der Landwirtschaft, 1855.
103. HAGEN, II. A., Stett. Ent. Zeit., XVI, 1855, p. 312.
104. BREMI-WOLF, J. J., Stett. Ent. Zeit., XVI, 1855, pp. 313-315.
105. FITCH, A., Count. Gent., VI, Dec. 13, 1855, p. 385.
106. FITCH, A., Trans. N. Y. St. Agr'l Soc., 1856; First Rep't on Ins. of N. Y., 1856, pp. 102-104.
107. VAN DER HOEVEN, J., Handbook of Zoology, I, 1856, p. 464.
108. NEWMAN, E., Trans. Ent. Soc. Lond., 2d ser., III, 1856, pp. 264-267.
109. FITCH, A., Ann. Rep't N. Y. St. Agr'l Soc., 1857, pp. 536-541; Second Rep't Nox. Ins. of N. Y., 1857, pp. 304-309.
- *110. GERSTAECKER, C. E. A., Archiv f. Naturgesch., XXIII, Pt. 2, 1857, p. 383.
111. KIRBY and SPENCE, Introd. to Entom., ed.?, 1857, pp. 67, 93, 114; 7th ed., 1858.
112. HIND, II. Y., Essay on Ins. and Diseases Inj. to Wheat Crops, 1857, pp. 105, 106.
- *113. REGEL, E., Bull. phys. math. Acad. St. Petersburg, XVI, 1858, pp. 333-336; Melang biolog., II, Pt. 6, pp. 628-633.
114. CARPENTER, W. B., Zoologie, II, 1858, pp. 152-153, fig. 102.
- *115. WESTWOOD, J. O., Cuvier's Animal Kingdom, Insecta, 1859, p. 571.
116. WALKER, FR., Ann. and Mag. Nat. Hist., 3d ser., XXIII, 1859, p. 224.
117. CURTIS, J., Farm Insects, 1860, pp. 285-289, fig. 38; pl. J, figs. 8, 9; pl. U, figs. 13-17, pp. 431, 432.
- *118. KOLENATI, F. A., Wien. Ent. Monatschrift, IV, 1860, pp. 381-394.
119. OSTEN-SACKEN, Stett. Ent. Zeit., XXII, 1861, p. 421.
120. DARWIN, C., Journ. Linn. Soc. Bot., VI, 1861, pp. 84, 86.

121. DÖHNER, Handb. d. Zoologie, Pt. 2, 1862, pp. 239-241.
122. OSTEN-SACKEN, Diptera of North America, 1862, p. 201.
123. WALSH, B. D., Proc. Ent. Soc. Phila., I, 1862, p. 310.
124. GERSTAECKER and CARUS, Handb. d. Zoologie, II, 1863, pp. 64, 65.
- *125. DARWIN, C., Ann. des Sci. Nat. Bot., 4th ser., XIX, 1863, pp. 204-229.
126. GIEBEL, C. G., Die Naturgesch. des Thierreichs, IV, 1863, pp. 327-328.
127. WALSH, B. D., Proc. Ent. Soc. Phila., III, 1864, pp. 609, 611-612.
- *128. TASCHENBERG, E. L., Naturgesch. d. wirbellosen Thiere, 1865, pp. 195-197, pl. iv, fig. 23.
129. WALSH, B. D., Practical Entomologist, I, 1865, p. 21.
130. WAGNER, R., Stett. Ent. Zeit., XXVII, 1866, p. 67.
131. DEYROLLE, E., Annales de la Soc. Ent. de France, 4th ser., VI, 1866, Bulletin, p. liv.
132. WALSH, B. D., Pract. Entomol., II, 1867, pp. 19, 49-51.
133. SCUDDER, S. H., Proc. Ent. Soc. Nat. Hist., XI, 1867, p. 117.
- *134. LOW, F., Verhandl. d. k. k. Zool.-Bot. Gesellsch., XVII, 1867, p. 747.
- *135. VON FRAUENFELD, G. R., Verhandl. d. k. k. Zool.-Bot. Gesellsch., XVII, 1867, pp. 793-801.
136. BOISDUVAL, J. A., Ent. Hortie., 1867, pp. 231-235, fig. 32.
137. SCUDDER, S. H., Geological Magazine, V, 1868, p. 221.
138. HUXLEY, T. H., Introd. to Classif. of Animals, 1869, p. 122.
139. PACKARD, A. S., Guide to Study of Ins., 1st ed., 1869, pp. 547-550.
140. WALSH-RILEY, Amer. Entomol., I, 1869, p. 227.
- *141. COHN, FERD., Unters. über Insektenschaden auf den schlesischen Getreidefeldern im Sommer 1869, 1869.
142. BOLD, T. J., Ent. Monthly Magazine, VI, 1869-1870, p. 171.
143. PACKARD, A. S., 17th Ann. Rep't Mass. Bd. Agric., 1870, p. 263, pl. i, fig. 2.
- 143^a. RILEY, C. V., Second Mo. Rep't, 1870, p. 6.
144. RILEY, C. V., Amer. Entomol., II, 1870, pp. 134, 135.
145. GODDICH, A. J., Johnson's Nat. Hist., II, 1870, p. 593.
146. CORNELIUS, C., Stett. Ent. Zeit., XXXI, 1870, pp. 325, 326.
147. MÜLLER, A., Trans. Ent. Soc. Lond., Proc., 1871, p. xl.
148. RILEY, C. V., Third Rep't Ins. Missouri, 1871, p. 29.
- *149. DE MAN, J. G., Tijdschrift v. Entomol., XIV, 1871 (2 ser. 6 D.), p. 147.
150. GLOVER, T., Rep't Dep't Agric. for 1871, 1872, pp. 86, 87, fig. 21.
- *151. BELING, T., Verhandl. k. k. Zool.-Bot. Gesellsch., XXII, 1872, pp. 651-654.
152. PACKARD, A. S., Seventeenth Ann. Rep't Sec'y Mass. Bd. Agric. for 1871, 1872, pp. 333-336, 2 figs; Second Ann. Rep't Ins. Mass., 1872, pp. 5-8, 2 figs.
153. MÜLLER, A., Ent. Monthly Magazine, IX, 1872, pp. 13-14.
154. FIGUIER, The Insect World, revised by Duncan, 1872, pp. 400-401, figs. 381, 382.
155. BENNETT, A. W., Nature, VIII, 1873, pp. 49-50, 143.
156. KITCHNER, Nature, VIII, 1873, p. 143.
157. HART, W. E., Nature, VIII, 1873, pp. 244-245.
158. HOLMGREN, A. E., Om skadliga insekter, 1873, pp. 55, 56, fig. 26.
159. RILEY, C. V., 5th Rep't Ins. of Missouri, 1873, pp. 16, 118.
160. TASCHENBERG, E. L., Naturgesch. der dem Gartenbau schädlichsten Insekten, 1874, pp. 409-420.
161. WOOD, Insects Abroad, 1874, pp. 347-349, fig. 172.
162. KALTENBACH, J. H., Die Pflanzenfeinde aus der Classe Insekten, 1874, pp. 42, 70, 103, 143, 216, 275, 290, 313, 405, 412, 425, 497, 501, 519, 706, 743, 744.
163. COOK, A. J., 3d Ann. Rep't Pom. Soc. Mich., 1874, p. 501.
164. LEWIS, J., Origin and Metamorphosis of Insects, 2d ed., 1874, pp. 3-6, pl. 3, 244, pl. 4, fig. 9.
165. RILEY, C. V., 6th Rep't Ins. of Missouri, 1874, pp. 50-51, fig. 9.

166. BETHUNE, C. J. S., 5th Rep't Ent. Soc. Ontario, 1875, p. 60.
167. GLOVER, T., Rep't U. S. Commissioner of Agric. for 1874, 1875, pp. 144-145.
168. TENNEY, Elements of Zoology, 1875, p. 331.
- *169. WITTMACK, L., Zeitsch. des landwirtschaftlichen Central vereins der Provinz Sachsen, XXXII, 1875.
170. COMSTOCK, J. H., Syllabus of Course of Lectures delivered at Cornell Univ., 1875, p. 120.
- *171. SCHÜYEN, W. M., De for Ager, Engoch Have skadligste Insekter og Smaakryb, 1875.
172. PAGENSTECHER, H. A., Allgemeine Zoologie, Pt. 1, 1875, p. 144.
173. OUSTALET, Bull. de la Soc. Philomatique de Paris, 1875.
174. SCUDDER, S. H., Bull. U. S. Geol. Geog. Surv. of Terr., 1, 1875, pp. 221-223.
175. DOHRN, A., Zeitsch. f. wiss. Zool., XXVI, 1876, p. 121.
176. CLAU, C., Grundzüge der Zoologie, 3d ed., I, 1876, pp. 644-645.
- *177. DIMITRIEWICZ, E., Kártékony rovarok, Foldmiv érlek, 25 sz., 1876.
178. BUTLER, A. G., Ann. and Mag. Nat. Hist., 4th ser., XVII, 1876, no. 101; XVIII, 1876, p. 412.
179. MACALISTER, A., Introd. to Animal Morphology and Syst. Zool., Pt. 1, 1876, p. 402.
- *180. FARWICK, Verhandl. d. naturh. Vereins d. preuss. Rheinlande und Westfalens, 4th ser., IV, 1877, p. 57.
- *181. BECKER, G., Verhandl. d. Vereins d. preuss. Rheinlande u. Westfalens, 4th ser., IV, 1877, pp. 168, 169.
- *182. KORNICKE, Verhandl. d. naturh. Vereins d. preuss. Rheinlande u. Westfalens, 4th ser., IV, 1877, p. 330.
183. TASCHENBERG, E. L., Brehm's Thierleben, 2d ed., IX, 1877, Insekten, pp. 567, 568, two figs.
- *184. DIMITRIEWICZ, N., Oesterreiches landwirtschaftl. Wochenblatt, III, 1877, No. 46.
- *185. LADUREAU, A., Ass'n Francaise pour l'avancement des sciences, Comte rendu de la 6 session, 1877, pp. 951-964.
186. PACKARD, A. S., Ann. Rep't U. S. Geol. Geog. Surv. Terr. for 1875, 1877, pp. 742-744, pl. LXVII, figs. 3-5.
187. TARGIONI-TOZZETTI, Annali di Agricoltura, I, 1878, p. 13.
- *188. ROTHCHILD, Musée Entomol., Les Insects, 1878, pp. 53-57, figs. 36, 37.
189. BOBRETZKY, N., Zeit. f. Wiss. Zool., XXXI, 1878, p. 202.
- *190. REUTER, O. M., Öfv. Fin. Soc., XXI, 1879, pp. 207-223.
191. PACKARD, A. S., Zool. for students and general readers, 1879, p. 370.
192. BUTLER, A. G., Philos. Trans. Roy. Soc. Lond., CLXVIII, 1879, pp. 552-553, pl. LIV, fig. 7.
- *193. LADUREAU, A., Etude sur la maladie dite brûlure du lin, 1879.
- *194. VON SZANISZLÓ, A., Verhandl. d. k. k. Zool.-bot. Gesellsch., XXIX, 1879, Sitzungsab., pp. 33-36.
195. REUTER, O. M., The Scottish Naturalist, V, 1880, pp. 310-311.
- *196. REUTER, O. M., Bidr. Finl. Nat., XI, 1880 (separate copy, pp. 1-26).
197. WESTWOOD, J. O., Gard. Chron., (2), XIV, 1880, p. 206, woodcuts.
198. ASHMEAD, W. H., Orange Insects, 1880, p. 72.
199. COSTE, A., Comptes Rendus, XCI, 1880, pp. 462-463.
- *200. TARGIONI-TOZZETTI, Bull. Ent. Soc. Ital., XII, Pt. 3, 1880, p. 250.
- *201. BERTKAU, P., Archiv. f. naturgesch., XLVI, Pt. 2, 1880, p. 386.
202. ALTUM, B., Forstzoologie, 2d ed., III, Pt. 2, 1881, p. 330.
203. PACKARD, A. S., Half hours with Insects, 1881, pp. 118-119, fig. 86.
204. HAGEN, H. A., Psyche, III, 1881, p. 196.
205. BENNETT, Psyche, III, 1881, p. 249.

206. DARWIN, C., *Psyche*, III, 1881, p. 250.
207. HART, W. E., *Psyche*, III, 1881, p. 254.
208. KITCHENER, *Psyche*, III, 1881, p. 256.
209. TARGIONI-TOZZETTI, *Annali di Agric.* No. 34, scientific part, 1881, pl. III, figs. 14, 15, Art. V, pp. 120-134.
210. TARGIONI TOZZETTI, *Bull. Ent. Soc. Ital.*, XIII, 1881, p. 210.
211. ORMEROD, E. A., *Manual Inj. Ins.*, 1881, pp. xxvii, xxviii, 86-88, figs.
212. HOWARD, L. O., *Rept. Dept. Agric.*, 1881, p. 137.
*213. LÜTKEN, C. F., *Dyreriget en Hand-og. Laerebog*, Kjobenhavn, 1881-82, p. 446.
214. LINTNER, J. A., *First Ann. Rept. Ins. N. Y.*, 1882, pp. 79, 303, 332.
*215. KRAUSS, H., *Zoologisches Jahresbericht*, f. 1880, Pt. 2, 1882, p. 185.
216. PERGANDE, Th., *Entom. Monthly Mag.*, XVIII, 1882, pp. 235-236.
217. PERGANDE, Th., *Entomologist*, XV, 1882, pp. 94-95.
218. OSBORN, H., *Psyche*, III, 1882, p. 369.
219. PERGANDE, Th., *Psyche*, III, 1882, p. 381.
220. LEFEVRE, E., *Entomologist*, XV, 1882, p. 240.
221. ———, *Wiener Entomologis. Zeitung*, I, 1882, p. 104.
222. DUNCAN, P. M., *The Transformations of Insects*, Sixth thous., 1882, pp. 376-377.
*223. OSBORN, H., *Iowa Homestead*, May 26, 1882; also in *Western Farm Journal*, XII, 1882, p. 148.
224. OSBORN, H., *Trans. Iowa St. Hort. Soc. for 1882*, 1883, pp. 205-209.
225. SAUNDERS, Wm., *13th Rept. Ent. Soc. Ontario for 1882*, 1883, p. 66.
226. SAUNDERS, Wm., *Ins. Inj. to Fruits*, 1883, pp. 138, 238.
227. PACKARD, A. S., *Guide to Study of Ins.*, 8th ed., 1883, pp. 69, 80, 378, 547-550.
228. PACKARD, A. S., *3d Rept. U. S. Entom. Commission*, Pt. 3, 1883, p. 297.
229. SICARD, HENRI, *Elements der Zoologie*, 1883, p. 422.
230. COOK, A. J., *Ins. Orchard, Vineyard, etc.*, 1883, pp. 122-123, figs. 100-102.
231. OSBORN, H., *Canad. Entomol.*, XV., 1883, pp. 151-156.
232. ALTUM and LANDOIS, *Lehrbuch der Zoologie*, 5th ed., 1883, p. 109.
233. CASSELL, *Natural History*, VI, 1883, pp. 146-147.
*234. PORTSCHINSKI, J., *Rev. mens. Ent.*, I, 1883, pp. 44-53.
235. CURTIS, J., *Farm Insects*, 2d ed., 1883, pp. 285-289, 431-432, pl. 2, figs. 7-9, pl. o, figs. 14-17.
236. PACKARD, A. S., *Amer. Nat.*, XVII, Pt. 2, 1883, pp. 820-829; *Ann. and Mag. Nat. Hist.*, (5), XII, 1883, pp. 145-154.
*237. COSTA, A., *Atti Acad. Napoli*, (2), I, 1883, p. 71.
*238. ———, *Entomologisk Tidskrift*, 1884, p. 90.
*239. ———, *Sitzungsb. d. Naturf. Gesell. bei Univ. Dorpat*, 1884, p. 149.
240. WITLACZIL, E., *Zeit. f. Wiss. Zool.*, XL, 1884, p. 633.
241. CLAUD and SEDGWICK, *Elem. Text-book of Zool.*, 2d ed., Pt. 1, 1884, p. 559; 4th ed., 1892.
*242. REUTER, O. M., *Rev. d. Ent.*, III, 1884, pp. 290, 291.
243. ORMEROD, E. A., *Guide to Methods of Ins. Life*, 1884, pp. 30, 149, 150, fig.
244. TARGIONI-TOZZETTI, *Letta alla R. Accad. dei Georgofili*, 1885; *Di Alcuni Rapporti della Coltivazioni Cogli Insetti*, 1885, pp. 31, 32, pl. 2, figs. 6, 7.
245. WHITEHEAD, *11th Rep't to Agr. Dept. Gt. Brit.*, 1885, pp. 152-153.
246. KIRBY, Wm., *Text-book of Entomology*, 1885, p. 95, 2d ed., revised and augmented, 1892, pp. 11, 12, 95.
247. OSBORN, H., *Coll. Bull. 2, St. Agrl. College, Iowa*, 1885, pp. 96-97; *Trans. Iowa St. Hort. Soc. for 1883*, XVIII, 1884, pp. 520-521.
248. WOOD, *Animate Creation*, III, 1885, p. 393.
*249. SCHNEIDER, A., *Zool. Beitrage*, I, 1885, pp. 257-300, pls. xxxii-xxxv.
250. ZIEGLER, *Handb. d. Palaeontology*, I, Pt. 2, 1885, p. 784, fig. 999.
251. ———, *Bull. Soc. Ent. d. Belgique*, 1885, p. lxx.

252. LINTNER, J. A., Second Rep't Ins. of N. Y., 1885, pp. 29, 31, 38, 56.
253. FERNALD, C. H., Grasses of Maine, 1885, p. 42.
- *254. COSTA, A., Atti Acad. Napoli, IV, 1885, p. 12.
255. BRAUER, F., Sitzungsber. d. Math.-naturw. Classe d. Akad. d. Wiss., XCI, Pt. 5, 1885, pp. 237-413.
- *256. WERNER, H., Handb. d. Getreidebaues, 1885.
- *257. KRAUSS, H., Zoologischer Jahresbericht für 1883, Pt. 2, 1885, p. 160.
258. ORMEROD, E. A., 8th Rep't Observ. of Inj. Ins. during 1884, 1885, pp. 28-31.
- *259. ———, Bull. Soc. Ent. Belgique, XXIX, 1885, p. 70.
260. HUBBARD, H. G., Ins. Orange, 1885, pp. 164, 165, fig. 77, pl. xi, fig. 5.
261. PEREZ, J., Comptes rendus, de l'Acad. d. Sciences, CII, 1886, pp. 181-183.
- *262. KRAUSS, H., Zoologischer Jahresbericht für 1886, Pt. 2, 1886, p. 222.
- *263. BERTKAU, PH., Archiv f. Naturgeschichte, LII, 1886, Pt. 2, p. 126.
264. TARGIONI-TOZZETTI, Atti d. R. Accad. d. Georgofili, 4th ser., VIII, 1886, pp. 425, 426; Bull. Ent. Soc. Ital., 1886, pp. 425, 426.
265. LEWIN, J., Synopsis d. Thierkunde, 3d ed., II, 1886, pp. 535-537, figs.
- *266. LINDEMAN, K., Bull. Soc. Imp. d. Naturalistes d. Moscow, LXII, 1886, No. 4, pp. 296-337, figs. 1-18.
267. SCUDDER, S. H., Bull. U. S. Geol. Surv., No. 31, 1886, p. 63.
- *268. CAMERON, Trans. Nat. Hist. Soc. Glasgow (new ser.), I, 1886, p. 301.
269. LINTNER, J. A., Thirty-third Rep't Mass. Bd. Agr. for 1885, 1886, p. 193; Some Inj. Ins. of Mass., 1886, p. 31.
270. ———, New England Farmer, editorial note, June 19, 1886.
271. WEBSTER, F. M., Rep't Dep't Agr. 1886, 1887, p. 577.
272. LINTNER, J. A., 40th Rep't N. Y. St. Mus. Nat. Hist. for 1886, 1887, pp. 96-98.
273. LONG, Our Insect Foes, 1887, p. 27.
274. NICHOLSON, H. A., Manual of Zoology, 7th ed., 1887, p. 408.
275. WOOD, Insects at Home, 1887, pp. 259-260, fig. xxvii.
- *276. WEED, C. M., Prairie Farmer, LIX, 1887, p. 343; Popular Gardening, III, May, 1887, p. 176.
277. LINTNER, J. A., Country Gentleman, LII, June 9, 1887, p. 459.
- *278. BERTKAU, PH., Archiv f. Naturgeschichte, LIII, Pt. 2, 1887, p. 131.
- *279. FORBES, S. A., Centralia, Illinois Sentinel, 1887; Prairie Farmer, June 4, 1887.
- *280. REDTENBACHER, J., Annalen d. k. k. Naturh., Hofmuseums, 1887.
- *281. v. SCHLECHTENDAL, D., Zeitschr. f. Naturwiss., LX, Pt. 6, 1887, pp. 551-592.
282. COOK, A. J., in W. J. Beal's Grasses of North America, I, 1887, pp. 375, 401.
- *283. SHIPLEY, A. E., Bull. 10, Miscel. Inform. Roy. Gardens, 1887, p. 18.
- *284. LINDEMAN, K., Entom. Tidskrift, VIII, Pts. 2-3, 1887, pp. 119-127.
285. ROLLESTON and JACKSON, Forms of Animal Life, 2d ed., 1888, p. 510.
286. HOWARD, L. O., Entomol. Amer., IV, 1888, p. 152.
287. SMITH, Entomol. Amer., IV, 1888, p. 152.
288. WEBSTER, F. M., Entomol. Amer., IV, 1888, p. 152.
289. FLETCHER, J., Entomol. Amer., IV, 1888, p. 152.
- *290. LINTNER, J. A., Vinyardist, II, May 1, 1888, p. 113.
- *291. LINTNER, J. A., Albany Evening Journal, July 7, 1888, p. 7, col. 3.
- *292. BERGROTH, E., Comptes rendus de la Soc. Ent. d. Belgique (3), No. 98, XXXII, 1888, p. xxx.
- *293. LINDEMAN, K., Die schädli. Insekten d. Tabak in Bessarabien, 1888, pp. 15, 61-75.
294. LINDEMAN, K., Psyche, V, 1888, p. 23.
- *295. HOSKINS, T. H., Garden and Forest, I, 1888, pp. 476-477.
296. OSBORN, H., Rep't U. S. Dep't Agr. for 1887, 1888, pp. 163-164.
297. THAXTER, R., Mem. Bost. Soc. Nat. Hist., IV, 1888, pp. 151, 172, 174, pl. xvii, figs. 200-219.

298. OSBORN, H., *Ins. Life*, I, 1888, pp. 137-142.
- *299. LÖW, F., *Wiener Landwirtschaftliche Zeitung*, 1888.
300. PACKARD, A. S., *Entom. for Beginners*, 1888, pp. 55, 73, figs. 58, 197.
301. PACKARD, A. S., *Riverside Nat. Hist.*, 2d ed., 1888, Appendix.
302. FLETCHER, J., 19th Rep't Ent. Soc. Ontario, 1888, p. 11.
303. WOOD, TH., *The Farmer's Friends and Foes*, 1888, pp. 154-155, fig.
304. TARGIONI-TOZZETTI, *Cronaca entomologica dell'anno 1887*, 1888, pp. 3, 5, 8 (or 5, 7, 10).
305. COMSTOCK, J. H., *Amer. Naturalist*, XXII, March, 1888, pp. 260-261.
306. JORDAN, K., *Zeit. f. Wiss. Zool.*, XLVII, 1888, pp. 541-620, pls. xxxvi-xxxviii, 91 figs.
307. LINTNER, J. A., *Fourth Rep't Ins. of N. Y.*, 1888, pp. 66, 198.
308. COMSTOCK, J. H., *Introduction to Entomol.*, 1888, pp. 123-127, figs. 111, 112.
309. RILEY-HOWARD, *Ins. Life*, I, 1888, p. 167.
- *310. ULIANIN, W. H., *Embryology of Physopoda*, Moscow, 1888?
311. FLETCHER, J., *Ann. Rep't Exp. Farms for 1888*, 1889, pp. 59-62.
312. RILEY-HOWARD, *Ins. Life*, I, 1889, p. 340.
313. NICHOLSON, *Dictionary of Gardening*, IV, 1889, pp. 30-31.
314. RILEY, C. V., *Ins. Life*, I, 1889, p. 301.
315. LINTNER, J. A., *5th Rep't Ins. of N. Y.*, 1889, pp. 302, 304.
316. JORDAN, K., *Journ. Roy. Micros. Soc. Lond.*, 1889, Pt. 2, pp. 203-204.
317. COTER, E. C., *Indian Museum Notes*, I, 1889, pp. 109, 110.
- *318. UZEL, J., *Puchýřnatky (Physopoda)*, *Vesmir. Praha. Bojovník osumáctý; Číslo* 21, 1889, pp. 241, 243, a 245; číslo 22, pp. 258, a 259.
319. THAXTER, R., *Ann. Rep't Conn. Agr. Exp. Sta. for 1889*, 1889, p. 180.
320. LANG, *Lehrbuch d. Vergleich. Anatomie*, Pt. 2, 1889, p. 454.
321. COMSTOCK, J. H., *Bull. XI, Cornell Agr. Exp. Sta.*, 1889, p. 131.
322. FLETCHER, J., 20th Rep't Ent. Soc. Ontario, 1890, pp. 2, 3.
323. BRODIE, 20th Rep't Ent. Soc. Ontario, 1890, pp. 8, 9.
324. WEBSTER, F. M., *Ins. Life*, II, 1890, p. 256.
325. RILEY-HOWARD, *Ins. Life*, II, 1890, p. 338.
- *326. MAYER, P., *Zoologischer Jahresbericht for 1888*, 1890, pp. 60-62.
327. GARMAN, H., *Bull. Essex Institute*, XXII, 1890, pp. 24-27.
328. RILEY-HOWARD, *Ins. Life*, III, 1890, pp. 34, 77, 128.
329. GARMAN, H., *Ins. Life*, III, 1890, p. 83.
330. GARMAN, H., *Canad. Entomol.*, XXII, 1890, pp. 215, 216.
331. FORBES, S. A., 16th Rep't St. Entom. of Ill., 1890, p. ix, pl. v, fig. 4.
332. KRÜGER, *Berichte d. Versuchs-Station f. Zuckerrohr in West Java*, 1890. (Noticed editorially in *Exp. Sta. Record*, Dec., 1891.)
333. MAYET, V., *Les Insects de la Vigne*, 1890.
334. HYATT and ARMS, *Guides for Science Teaching*, No. VIII, 1890, pp. 113-114, fig. 62.
335. ORMEROD, E. A., *Manual of Inj. Ins.*, 2d ed., 1890, pp. 97-99, 384.
336. SCUDDER, S. H., *Rept. U. S. Geol. Surv. Terr.*, XIII, 1890, pp. 371-374, figs.
337. LINTNER, J. A., 7th Rept. Ins. of N. Y., 1891, pp. 316, 366, 384.
338. OSBORN, H., *Canad. Entom.*, XXIII, 1891, pp. 93-96.
339. EDWARDS, 21st Rept. Ent. Soc. Ontario, 1891, p. 103.
340. FORBES, S. A., 17th Rept. Ins. Illinois, 1891, pp. xiii, xv.
341. MALLY, F. W., *Bull. 24, U. S. D. A., Div. of Entom.*, 1891, pp. 30-31.
342. LANE, *Textbook of Comparative Anatomy*, Transl. by H. M. and M. Bernard, I, Pt. 1, 1891, p. 440.
343. RILEY-HOWARD, *Ins. Life*, III, 1891, p. 301.
344. WEBSTER, F. M., *Ins. Life*, III, 1891, p. 453.
- *345. REIZNER, BOS, *Tierische Schädl. u. Nutzl.*, 1891, pp. 574-578, fig. 349.

346. TARGIONI-TOZZETTI, Animali ed Insetti del Tabacco in Erba del Tabacco Secco, 1891, pp. 222-224.
347. BOHLS, J., Die Mundwerkzeuge d. Physapoden, Inaug. dissert. Göttingen, 1891, 38 pp.
348. BAKER, Amer. Florist, VII, 1891, p. 168, fig.
349. WEED, C. M., Insects and Insecticides, 1891, p. 95.
- *350. REUTER, O. M., Meddal. af. Societas pro Fauna et Flora Fennica, XVII, 1891, pp. 161-167.
- *351. HOFMANN, J. H., Verein f. vaterl. Naturkunde in Württemberg, XLVII, 1891, pp. 24-28.
352. COQUILLETT, D. W., Ins. Life, IV, 1891, p. 79.
353. FERNALD, C. H., Bull. 19, Mass. Exp. Sta., 1892, p. 116.
354. RILEY-HOWARD, Ins. Life, IV, 1892, p. 354.
355. RILEY, C. V., Ins. Life, V, 1892, p. 18.
356. OSBORN, H., Ins. Life, V, 1892, pp. 112-113.
357. FLETCHER, J., Ins. Life, V, 1892, pp. 124, 125.
358. FORBES, S. A., Ins. Life, V, 1892, pp. 126, 127.
359. WEBSTER, F. M., Ins. Life, V, 1892, p. 127.
360. TOWNSEND, C. H. T., Canad. Entom., XXIV, 1892, p. 197.
361. SCHNEIDER, Book of Choice Ferns, I, 1892, pp. 170, 172.
362. KOBUS, J. D., Bull. 43, Proefstation, Oost-Java, 1892, figs. 1-4.
363. GILLETTE, C. P., Ann. Rept. Col. Exp. Sta. for 1892, 1892, p. 36.
- *364. RILEY, C. V., Bull. 39, Smithsonian Inst., Part F, 1892, pp. 13-19, fig. 22.
- *365. TASCHENBERG, E. L., Brehm's Thierleben, IX, 1892, pp. 609-611, 2 figs.
366. CLAU and SEDGWICK, Elem. Textbook of Zool., 4th ed., I, 1892, p. 559.
367. LINTNER, J. A., Country Gentleman, Oct. 27, 1892, p. 809.
368. ORMEROD, E. A., Textbook of Agric. Entom., 1892, pp. 33, 195-197.
369. TARGIONI-TOZZETTI, Animali ed Insetti del Tabacco in Erba e del Tabacco Secco, 1892, pp. 9, 10.
370. LUGGER, O., Bull. 23, Univ. of Mich. Agr. Exp. Sta., 1893, pp. 120-121.
371. GREEN, Indian Museum Notes, II, 1893, No. VI, p. 172.
372. KOLBE, H. J., Einführung in die Kenntniss der Insekten, 1893, pp. 211, 225, 234, 287, 598.
373. LINTNER, J. A., 8th Rept. Ins. of N. Y., 1893, pp. 254, 255.
374. FLETCHER, J., Ann. Rept. Exp. Farms for 1892, 1893, p. 145.
375. BRÜNER, L., Rept. Neb. St. Bd. Agr. for 1893, 1893, p. 457, fig. 96.
376. WOODWORTH, C. W., Rept. Agr. Exp. Sta. Univ. Calif. for 1891-1892, 1893.
377. DAVIS, G. C., Bull. 102, Mich. Agr. Exp. Sta., 1893, p. 39, fig. 10.
- *378. JABLONOWSKI, J., Potfuz. Termes. Kozl., XXII, 1893, pp. 17-24.
379. GILLETTE, C. P., Bull. 24, Col. Agr. Exp. Sta., 1893, pp. 13-16.
380. LINTNER, J. A., Ninth Rept. Ins. of N. Y., 1893, pp. 377, 445.
381. SMITH, J. B., Ann. Rept. N. J. Agr. Col. Exp. Sta. for 1893, 1893, p. 441.
382. GILLETTE, C. P., Ann. Rept. Col. Exp. Sta. for 1893, 1893, p. 55.
383. HOSKINS, Psyche, VI, 1893, p. 557.
384. RILEY-HOWARD, Ins. Life, VI, 1893, p. 45; 1894, pp. 211, 343.
385. OSBORN, H., Ins. Life, VI, 1893, pp. 74, 80.
386. ASHMEAD, W. H., Ins. Life, VII, 1894, p. 27.
387. TRYBOM, F., Entom. Tidskr., XV, Pts. 1, 2, 1894, pp. 41-58.
- *388. BRUNER, L., Ann. Rept. Neb. St. Bd. Agr. for 1893, 1894.
389. McMURRICH, J. P., Textbook of Invertebrate Morphology, 1894, pp. 509, 510, 526.
390. DAVIS, G. C., Bull. 116, Mich. Agr. Exp. Sta., 1894, pp. 62, 63.
- *391. JABLONOWSKI, J., Termes Fuzetek, XVII, 1894, pp. 44-47, pl. III; pp. 93-99, pl. IV.
392. WEBSTER, F. M., Ins. Life, VII, 1894, p. 206.

393. SIRHINE and LOWE, Bull. 83, new series, N. Y. Agr. Exp. Sta., 1894, pp. 680-682, pl. II; also in 13th Ann. Rept. N. Y. Exp. Sta. for 1894, 1895, pp. 758-760, pl.
- *394. REITER, E., Finska Landtbruksstyrelsens Meddelanden, 1894, No. VII.
395. DUFFY-PERGANDE, Trans. St. Louis Acad., V, 1894, pp. 533-542, pls. x, xi.
396. NAGEL, WIL., Biol. Zool., XVIII, 1894, pp. 67-132; Summary in Biol. Centrabl., XIV, pp. 547-551.
397. WEBSTER, F. M., Ohio Farmer, Aug. 2, 1894, p. 97; Aug. 23, 1894, p. 157; Nov. 7, 1895, p. 373.
398. SMITH, J. B., Rept. Entomol. N. J. Agr. Col. Exp. Sta. for 1893, 1894, p. 441.
399. CRAW, A., Fourth Bien. Rept. St. Bd. Hort. Calif. for 1893-94, 1894, pp. 87, 88.
400. WOODWORTH, C. W., Fourth Bien. Rept. St. Bd. Hort. Calif. for 1893-94, 1894, p. 140.
401. BRUNER, L., Introd. to Entomology, 1894, pp. 9, 44, 135, 139, 186, 202, 295.
402. BRUNER, L., Rept. Neb. St. Hort. Soc. for 1894, 1894, pp. 163, 214, fig. 82.
403. COCKERELL, T. D. A., Bull. 15, N. Mex. Agr. Exp. Sta., 1895, p. 71.
404. OSBORN-MALLY, Bull. 27, Iowa Agr. Exp. Sta., 1895, pp. 139-142.
405. WEBSTER, F. M., Bull. 58, Ohio Agr. Exp. Sta., 1895, pp. xxxiii, xxxiv, fig. 3.
406. ORMEROD, E. A., 18th Rept. Obs. on Inj. Ins., 1895, p. 41.
407. COTES, E. C., Indian Museum Notes, III, 1895, p. 43.
408. COMSTOCK, J. H., Manual for the Study of Ins., 1895, pp. 119-120, figs. 137, 138.
409. UZEL, H., Monographie d. Ord. Thysanoptera, 1895, 500 pp., 10 pls.
- *410. ———. Archiv f. Naturgeschichte, LXI, Pt. 2, 1895, p. 214.
- *411. UZEL, H., Zool. Centrabl., III, No. 24, 1895, pp. 845-848.
412. TRYBOM, F., Entom. Tidskr., XVI, Pts. 1-2, 1895, pp. 157-194.
- *413. BLOESCH, Feuille Natural, XXV, 1895, p. 76.
414. PERGANDE, TH., Ins. Life, VII, 1895, pp. 390-395.
415. SHARP, D., Cambridge Nat. Hist., V, 1895, pp. 172, 173, 175.
416. LINTNER, J. A., 49th Rept. N. Y. St. Mus. Nat. Hist., 1896, pp. 241-250; also, as 11th Rept. Ins. of N. Y. for 1895, 1896, pp. 241-250.
417. DAVIS, G. C., Special Bull. No. 2, Mich. Agr. Exp. Sta., 1896, pp. 13-14, fig. 4.
418. BEACH, A. M., Proc. Iowa Acad. Sc., 1895, III, 1896, pp. 214-227.
419. OSBORN, H., Proc. Iowa Acad. Sc., 1895, III, 1896, p. 228.
420. BERGROTH, E., Ann. Soc. Ent. Belgique, XL, 1896, pp. 66-67.
421. PERGANDE, TH., Entomological News, VII, 1896, pp. 63-64.
422. HOPKINS-RUMSEY, Bull. 44, W. Va. Agr. Exp. Sta., 1896, pp. 270-271.
423. TRYBOM, F., Ofv. Ak. Forh., 1896, pp. 613-626.
424. TRYBOM, F., Ent. Tidskr., XVII, 1896, pp. 87-104, figs 1-4. Abstract in Amer. Nat., XXXI, 1897, pp. 545-546, 4 figs.
425. TRYBOM, F., Lilljeborgs Festskrift, 1896, pp. 213-229.
- *426. LADUREAU, A., La Nature Ann., XXIV, 1896, p. 80, 1 fig.
427. SLINGERLAND, M. V., Rural New Yorker, LV, 1896, p. 561.
428. GARMAN, H., Amer. Naturalist, XXX, 1896, pp. 591-593, 1 pl.
429. TRYBOM, F., Zool. Centrabl., IV, No. 12, 1896, p. 419.
430. THEOBALD, F. V., Insect Life, 1896, pp. 200, 210, 211 (London).
431. FRANK, Die tierparasitären Krankheiten d. Pflanzen, 1896, pp. 131-134, fig. 35.
432. SMITH, J. B., Economic Entomology, 1896, pp. 101-103, fig 73.
433. ZEHNTNER, L., Overzicht van de Ziekten van het Suikerriet op Java 2 deel. Vijanden nit het Dierenryk. Arch. Java-Suikerind, 1897, 10 pp. See also Zool. Centrabl., 1898, p. 803.
- *434. BRITTON, W. E., 20th Rept. Conn. Exp. Sta. for 1896, 1897.
- *435. JABLONOWSKI, J., Potfuz. Termes. Kozl., 1897, pp. 146-157.
436. SOMMERVILLE, WM., Farm and Garden Ins., 1897, pp. 60, 61, fig. 20.
437. COMSTOCK, J. H., Insect Life, 1897, pp. 74, 75, fig. 57.
438. SIRHINE, F. A., 15th Ann. Rept. N. Y. St. Exp. Sta. for 1896, 1897, pp. 612-613.

439. QUAINTANCE, A. L., Bull. 42, Fla. Agr. Exp. Sta., 1897, pp. 552-564.
440. PACKARD, A. S., Zoology for high schools and colleges, 10th ed., 1897, p. 348.
441. TAPLIN, W. H., Garden and Forest, X, Mar. 17, 1897, p. 106.
- *442. ROLFS, P. H., 10th Ann. Meet. Fla. St. Hort. Soc., 1897, p. 97.
443. ECKSTEIN, Forstliche Zoologie, 1897, p. 566.
444. SIRRINE, F. A., Bull. 115, N. Y. St. Agr. Exp. Sta., 1897, p. 70.
445. SLINGERLAND, M. V., Rural New Yorker, May 8, 1897, p. 309.
- *446. LUCAS, ROB., Archiv f. Naturgeschichte, LXI, 1897.
- *447. ACLOQUE, A., Fauna de France, II, 1897, Orthopteres.
448. REUTER, O. M., Acta Soc. Fauna Flora Fenn., XVII, 1897?, No. 2, 69 pp., fig. Abst. in Zeitsch. f. Entom., V, Dec. 15, 1900, p. 387.
449. HOWARD, L. O., Bull. 18 (new ser.), U. S. Dept. Agr., 1898, p. 101.
450. LINTNER, J. A., 51st Ann. Rept. N. Y. St. Mus. Nat. Hist., 1898, p. 363. Also in 13th Rept. Inj. Ins. of N. Y., 1898, p. 363.
451. ROLFS, P. H., 11th Ann. Meet. Fla. St. Hort. Soc., 1898, pp. 34, 38.
452. PUTNAM, F. A., New England Farmer, July 2, 1898.
453. BUFFA, P., Riv. Patol. Veget., VII, No. 1-4, 1898, pp. 94-108.
454. QUAINTANCE, A. L., Bull. 46, Fla. Agr. Exp. Sta., 1898, pp. 77-114, 12 figs.; Abst. in Exp. Sta. Record, X, No. 9, pp. 867, 868.
455. PACKARD, A. S., Textbook of Entomology, 1898, p. 597.
456. HOWARD, L. O., Yearbook, U. S. Dept. Agr. for 1898, 1899, pp. 142, 143, fig. 27.
- *457. MATSUMURA, M., Zool. japon., III, No. 1, 1899, pp. 1-4, 1 pl.
458. BUFFA, P., Riv. di Patol. Veget. VII, Nos. 5-8, 1899, pp. 129-135, 136-142, pl. v, figs. 1, 2, 3; pl. VIII, figs. 19-22.
459. BRUNER, L., Ann. Rept. Neb. St. Hort. Soc. for 1898, 1899.
460. PUPPEL, M., Schr. nat. Ges. Danzig. N. F., X, 1899, pp. 46-48.
461. CARPENTER, G. B., Insects, their Structure and Life, 1899, pp. 183-185, fig. 100.
462. SHARP, D., Cambridge Nat. Hist., VI, 1899, pp. 526-531, fig. 254.
- *463. DEL GUERCIO, G., Atti della R. Acad. dei Georgofili, XXII, No. 1, 1899, pp. 50-76, 6 figs. Also in Bull. Soc. Ent. Ital., XXX, pp. 165-186, 6 figs; also in Nuove Relazioni della R. Sta. di Ent. Agraria, No. 1, 1899, pp. 207-233, 5 figs.
464. PETTIT, R. H., Bull. 175, Mich. Agr. Exp. Sta., 1899, pp. 343-345, figs. 1, 2.
465. QUAINTANCE, A. L., Bull. 20 (new ser.), U. S. Dept. Agr., 1899, p. 59.
466. WEBSTER, MALLY, Bull. 20 (new ser.), U. S. Dept. Agr., 1899, pp. 69-70.
467. TRYBOM, F., Ent. Tidskrift, XX, 1899, pp. 194-196, 267-277.
468. SCHENKLING, S., Illust. Zeitsch. f. Entom., V, No. 1, Jan., 1900, p. 9.
469. HINDS, W. E., 37th Ann. Rept. Mass. Agr. College, 1900, pp. 81-105, 4 pls., 33 figs.
470. SMITH, J. B., Rept. Entom. Dept. N. J. Agr. Exp. Sta. for 1899, 1900, pp. 427, 428.
471. FERNALD-HINDS, Bull. 67, Mass. Agr. Exp. Sta., 1900, pp. 1-12, 1 pl.
472. REUTER, E., Acta Soc. Fauna Flora Fenn., XIX, 1900, pp. 16, 17, 68-75, 92-94, 97-99, 115, 116, 117, 120.
473. TUMPPEL, R., Die Geradflügler Mitteleuropas, 1901, pp. 278-298, pl. XXIII, 7 figs.
474. GARMAN, H., Bull. 91, Kentucky Exp. Sta., 1901, pp. 42-45.
475. LEONARDI, G., Gli Insetti Nocivi, IV, 1901, pp. 614-657.
476. WEBSTER, F. M., Journ. Columbus Hort. Soc., XVI, No. 3, 1901, 7 pp., 4 figs.
477. HINDS, W. E., Proc. 17th Ann. Conv. Soc. Amer. Florists, 1901, pp. 90-92.
- *478. LUCAS, R., Archiv f. Naturgesch., LXV, ii, 1901, p. 900.
- *479. REUTER, O. M., Ofv. Finska Vetensk. Forh. Helsingfors, XLIII, 1901, p. 214.
480. CHITTENDEN, F. H., Florists' Review, April 17, 1902, pp. 738-740.

INDEX TO GENERAL SUBJECTS.

	Page
Introduction	79
History of Thysanoptera	81
Systematic position of Thysanoptera	82
Collection of Thysanoptera	84
Preservation and mounting	85
External anatomy	87
Integument: adult, larva, pupa	87
Head: antennæ	89
Organs of vision: eyes, ocelli	91
Mouth parts: labrum, maxilla, labium, mandible, maxillary lobes, other mouth structures, movements of mouth parts	91
Thorax: prothorax, mesothorax, metathorax, variation in structure of pterothorax in wingless species	95
Appendages of the thorax	98
Legs: coxa, trochanter, femur, tibia, tarsus, spines, bladder, bladder mechanism, other organs of doubtful function	98
Wings: venation, fringing, spines upon wings, taking flight, coordination of the wings, reduction of the wings	101
Abdomen: Terebrantia, Tubulifera	105
Sexual characters	107
Terebrantia: female, ovipositor; male	107
Tubulifera: female, male, copulation	109
Deformities	110
Reproduction: bisexual reproduction, unisexual reproduction	110
Dissemination	111
Development: oviposition, egg, embryology, emergence of the larva, larval stage, moits, nymph or pupa, hibernation, length of life	112
Economic considerations	116
Injurious forms: feeding habits	116
Beneficial forms: predaceous thrips, flower fertilizers	117
Natural checks: insects and acari, etc., plant parasites, ruin	119
Artificial checks: insecticides, cultural methods	119
Characters of Thysanoptera	121
Method of measurements	122
Individual variations	123
Synopsis of suborders and families	124
Characters of Terebrantia	124
Characters of Aeolothripidae	126
Characters of Thripidae	132
Synopsis of Thripidae	133
Characters of Tubulifera (Phloeothripidae)	136
Synopsis of Phloeothripidae	137
Unclassified descriptions	208
Fossil Thysanoptera	210
General considerations	213
Bibliography	221
Index to families, genera and species	233
Index to food plants	234
Explanation of plates	236

INDEX TO FAMILIES, GENERA, AND SPECIES.

Family names are in small caps. Generic names begin with a capital, and specific names are in small type. Synonyms are italicized.

References to descriptions are in heavy type.

	Page		Page.
Acanthothrips	188, 196, 198 , 199	dracænæ.....	82, 111, 175, 176
<i>adonidum</i>	168, 169	Empusa	119
ÆOLOTHRIPIDÆ	87,	Entomophthora	119
89, 90, 93, 99, 102, 103, 104, 108, 109,		Eurythrips.....	187, 202 , 203
124, 126 , 186, 216, 217, 218, 219		Euthrips.....	116,
Æolothrips	96, 102, 127 , 128, 130	120, 133, 147 , 148, 152, 154, 155, 156	
Aleurodes	118	extincta	210
<i>alli</i>	179	fasciapennis.....	168, 171
ambitus.....	191	fasciata	127, 128, 174
ampliventralis.....	202	fasciatus.....	127 , 132, 168, 174
Anaphothrips	107, 111, 112,	femoralis	168, 172
115, 118, 119, 129, 132, 133, 160 , 161		fossilis	212
<i>antennatus</i>	134 , 136	fuscipennis.....	159
Anthothrips	188	fuscus	148, 154
Aphidæ.....	105, 111	gossypii.....	118
Aptinothrips... 90, 111, 124, 133, 166 , 167		grass thrips.....	120, 161 , 165
aspersus	205	Gyrophæna	119
Aspidiotus	175	hæmorrhoidalis	111, 168, 169
ater	119	<i>Heliothrips</i>	82, 176
aurantii.....	175	Heliothrips.....	87, 91, 97,
avenæ	139	111, 113, 133, 168 , 169, 171, 172, 174	
beachi.....	191, 192	Idolothrips	188 , 206
bicolor	130 , 132	inequalis	132, 146
black fly.....	170	insidiosus	119
brunnea	82, 110	<i>Limothrips</i>	79, 80, 161, 179, 183, 208
caryæ	79, 209	Limothrips	90, 133, 138 , 139
caryæ-foliæ	118	Lithadothrips	210 , 211
Cephalothrips.....	188, 194	<i>longipennis</i>	134
cerealium.....	138, 208	longistylota	160
<i>cestri</i>	172	Macrosporium.....	119
Chirothrips	90, 95, 98, 105,	maculata	119
108, 112, 125, 126, 133 , 134, 136, 137		magnafemoralis	199
Chrysopa	119	<i>maialis</i>	155, 156
cingulatus.....	141	Malacothrips.....	188, 200
<i>Coccus</i>	81	<i>mali</i>	79, 209
<i>Coleothrips</i>	127, 128	manca	119
<i>communis</i>	81, 179, 180	manicata	134
coniferarum.....	206	manicatus	105, 133, 134
connaticornis.....	90, 166, 167	Megilla	119
crassus	133, 136	Melanothrips.....	210
Cryptothrips.....	188, 205	minuta	119
Cynipidæ	118	mites	118, 158

	Page.		Page.
<i>nervosa</i>	155	<i>6-maculata</i>	157
<i>nervosus</i>	148, 155	<i>6-maculatus</i>	118, 157
<i>niger</i>	188	<i>sphaerosperma</i>	119
<i>nigra</i>	188	<i>striata</i> ?	81, 179
<i>nigriventris</i>	154	<i>striata</i>	81, 161
<i>obesus</i>	108, 112, 133, 137	<i>striatus</i>	179
<i>occidentalis</i>	148, 152, 154	<i>striatus</i>	107, 111,
<i>onion thrips</i>	120, 179, 183, 184	112, 115, 118, 119, 120, 132, 160, 161	
<i>osborni</i>	202, 203	<i>styliifera</i>	166
<i>Palaethrips</i>	211, 212	<i>Syrphus</i>	119
<i>pallida</i>	157, 158	<i>tabaci</i>	81,
<i>Parthenothrips</i>	87,	111, 116, 117, 119, 120, 179, 180, 183	
90, 91, 102, 111, 133, 175, 176, 217		<i>THRIPIDÆ</i>	79, 87, 88, 89, 90, 93, 95,
<i>pergandei</i>	197	96, 99, 102, 103, 104, 108, 116, 118,	
<i>perplexa</i>	184	124, 132, 133, 186, 216, 217, 218, 219	
<i>perplexus</i>	108, 112, 179, 184	<i>Thrips</i>	79, 80, 81, 118, 127,
<i>PHLEOTHRIPIDÆ</i>	87, 89, 90,	134, 143, 145, 146, 148, 152, 155, 156,	
93, 96, 98, 99, 100, 101, 103, 104, 114,		157, 158, 161, 166, 168, 169, 176, 183	
118, 186, 187, 215, 216, 217, 218, 219		<i>Thrips</i>	81,
<i>Philothrips</i>	161, 188, 189	82, 108, 111, 112, 116, 117, 118, 119,	
<i>Phloeothrips</i>	79,	120, 133, 178, 179, 180, 183, 184, 209	
82, 110, 113, 188, 195, 196, 197, 209		<i>THRIPSIDÆ</i>	81
<i>Phylloxera</i>	118	<i>THRIPSITES</i>	81
<i>phylloxerae</i>	79, 118	<i>Trichothrips</i>	187, 191, 192
<i>PHYSAPI</i>	81	<i>3-fasciata</i>	128
<i>PHYSAPODES</i>	81	<i>trifasciata</i>	128
<i>Physapus</i>	147	<i>trifasciatus</i>	118, 209
<i>Physopus</i>	81, 147, 154, 155	<i>Triphleps</i>	119
<i>pocephagus</i>	80, 161	<i>tritici</i>	79, 179, 183, 208
<i>Pseudothrips</i>	132, 133, 146	<i>tritici</i>	116, 120, 147, 148, 154
<i>Raphidothrips</i>	133, 158, 159	<i>Trombidium</i>	119
<i>red spider</i>	118, 158	<i>uzeli</i>	196
<i>rufa</i>	166	<i>variabilis</i>	141, 143, 145
<i>rufus</i>	90, 111, 124, 166, 167	<i>verbasci</i>	188, 189
<i>Scolothrips</i>	133, 157	<i>VESTIARSEN</i>	81, 82
<i>Scymnus</i>	119	<i>vetusta</i>	211
<i>secticornis</i>	209	<i>wheat thrips</i>	148, 183
<i>Sericothrips</i>	184	<i>yuccæ</i>	194
<i>Sericothrips</i>	88, 102, 133, 141, 143	<i>zonatus</i>	200

INDEX TO FOOD PLANTS.

Generic names begin with capitals, specific and common names with small letters. Scientific names are italicized.

	Page.		Page.
<i>Abies</i>	208	apple	150, 181
<i>Achillea</i>	189	apricot	153
<i>æthiopica</i>	173	<i>aquatica</i>	162
<i>Agropyrum</i>	162	<i>arachnifera</i>	162
<i>Agrostis</i>	162	<i>Aralia</i>	173
<i>alba</i>	162	<i>Arrhenatherum</i>	162
alfalfa	129, 150	<i>Arum</i>	173
<i>Althea</i>	150	<i>asparagus</i>	150
<i>Amarilis</i>	173	<i>Aspidium</i>	170

	Page.		Page.
aster.....	147, 150, 181	<i>Elymus</i>	162
<i>Avena</i>	162	English pea	150
<i>avenaceum</i>	162	<i>Erechthites</i>	181
<i>Azalea</i>	170	<i>erectus</i>	162
<i>bahnorina</i>	177	<i>Erigeron</i>	181
bean.....	158	<i>Eucharis</i>	173
<i>bicolor</i>	150	ferns	170
bindweed	132, 150	<i>Festuca</i>	138, 141, 162
blackberry	150, 158	<i>Ficus</i>	173, 177
blanket flower.....	181	<i>filamentosa</i>	195
blue grass.....	181	<i>flavescens-vera</i>	162
<i>Bromus</i>	162	<i>fletcheri</i>	162
<i>Brunella</i>	132	four-o'clock	181
buckwheat.....	129, 130	<i>Gardenia</i>	173
buttercup.....	150	garden leek	181
calbhage.....	181, 184	<i>glomerata</i>	185
<i>caesia</i>	162	goldenrod.....	150, 181, 195
<i>canadensis</i>	181	<i>Cotysypium</i>	173
candytuft	181	<i>grandiflora</i>	173
<i>canina</i>	162	grape	206
<i>caninum</i>	162	grass	146, 155, 160, 172, 185, 192, 198
canna	150	grasses	129, 132, 135, 143, 150, 156, 167, 185, 189, 197, 205
<i>cupilure</i>	137	hackberry	145
catnip	181	hardhack	150
cauliflower.....	181	<i>hastata</i>	170
celery	129, 181	hawthorn.....	145
cereals	135	heal-all	150, 181
<i>Cestrum</i>	173	heliotrope	150
cherry	150	<i>heterophylla</i>	162
chickweed	181	honeysuckle	150, 181
<i>Chrysanthemum</i>	173	hop	158
cinquefoil.....	181	<i>Hydrangea</i>	150, 173
<i>Clematis</i>	145	<i>inermis</i>	162
clover	129, 130, 135, 145, 150, 181, 197	<i>iops</i>	208
<i>Composita</i>	129	Jamestown-weed	181
<i>compressa</i>	162	jimson	181
cone-flower	150, 181	June grass	120, 165
corn	156, 185	<i>Juniperinus</i>	208
cottonwood	158	kale	181
crab-grass.....	181	<i>Kentia</i>	177
<i>Crinum</i>	173	<i>Liliaceae</i>	170
<i>Croton</i>	170	lilies.....	150
<i>crus-galli</i>	162	<i>lobata</i>	173
cucumber	146, 173, 181	<i>Lolium</i>	162
<i>Cyperus</i>	185	melons	181
<i>Dactylis</i>	185	mesquite	150
dahlias	170	mignonette	181
dandelion	150, 181	<i>millefolium</i>	189
dog-tooth violet	150	<i>Mina</i>	173
<i>Dracena</i>	173, 177	<i>montana</i>	197
<i>duriuscula</i>	162	moonflower	173
<i>elastica</i>	173, 177	mullein	181, 191
<i>elatio</i>	162	<i>nasturtium</i>	181
elm	145, 158		

	Page.		Page.
<i>nemoridis</i>	162	shrubby <i>Althea</i>	150
<i>nocturnum</i>	173	silver top.....	120, 165
<i>oats</i>	129, 130, 141	<i>simplex</i>	150
<i>olecoll</i>	162	smartweed.....	146, 150
onion.....	129, 181, 184	<i>Solidago</i>	150
orange.....	150, 153, 175	<i>Specularia</i>	181
<i>orizum</i>	138, 162	<i>Spiranthes</i>	150
ox-eye daisy.....	189	squash.....	150, 181
<i>Pandanus</i>	173	<i>stolonifera</i>	162
<i>Panicum</i>	132, 137, 162, 185	stonecrop.....	181
parsley.....	181	strawberry.....	150
pea.....	150	<i>striatus</i>	162
peach.....	150	sunflower.....	150
pear.....	150	sweet clover.....	150, 181
<i>Pellaea</i>	170	sweet william.....	150
<i>pendula</i>	197	<i>Tanacetum</i>	130
<i>peregrina</i>	162	tansy.....	129, 130
<i>Phleum</i>	162	timothy.....	165, 181
<i>Phlox</i>	170	tobacco.....	181
<i>Phoenix</i>	173	tomato.....	173, 181
pink.....	150, 170, 181	<i>trivialis</i>	162
<i>Pinus</i>	208	turf.....	167, 202
plum.....	150, 181	turnip.....	181
<i>Poa</i>	120, 138, 162, 165	<i>Ulmus</i>	197
potato.....	150, 153	<i>Verbena</i>	170
<i>pratense</i>	162	vines.....	170
<i>pratensis</i>	120, 138, 141, 162, 165	<i>virginiana</i>	208
pumpkin.....	181	<i>virginicus</i>	162
quince.....	193	<i>Vitis</i>	173
raspberry.....	150	<i>vulgare</i>	130
red clover.....	150, 189	<i>vulgaris</i>	132, 162
<i>Richardia</i>	173	weeds.....	129, 153
rose.....	150	wheat.....	129, 150, 181
<i>rubra</i>	162	white blast.....	184
<i>Rubus</i>	181	white clover.....	189
<i>sanguinule</i>	132, 162, 185	white top.....	165
<i>serotina</i>	162	wild carrot.....	135
shepherd's purse.....	181	<i>Yucca</i>	195

EXPLANATION OF PLATES.

In the figures of wings of species of Terebrantia the hind fringes are not fully represented on account of their great length.

PLATE I.

- Fig. 1. *Acolothrips fasciatus* Linnæus. Head, prothorax, antennæ, and fore legs of female. $\frac{62}{1}$.
2. *Acolothrips fasciatus*, left fore wing of female. $\frac{62}{1}$.
3. *Acolothrips fasciatus*, end of abdomen of female. $\frac{62}{1}$.
4. *Acolothrips bicolor*, new species. Head, prothorax antennæ, and fore legs of female. $\frac{62}{1}$.
5. *Acolothrips bicolor*, end of abdomen of female. $\frac{62}{1}$.

Fig. 6. *Eolothrips bicolor*, anterior part of abdomen at junction with metathorax showing first abdominal segment of male. $\frac{85}{1}$.

7. *Eolothrips bicolor*, end of abdomen of male. $\frac{85}{1}$.

8. *Eolothrips bicolor*, left antenna of male. $\frac{62}{1}$.

9. Fore tarsal hook present in both sexes of *Eolothripidae*. $\frac{213}{1}$.

10. *Limothrips arenae*, new species. End of abdomen of female. $\frac{85}{1}$.

11. *Limothrips arenae*, end of abdomen of male. $\frac{85}{1}$.

12. *Limothrips arenae*, right fore wing of female. $\frac{62}{1}$.

PLATE II.

Fig. 13. *Limothrips arenae*, new species. End of abdomen of female. $\frac{85}{1}$.

14. *Chirothrips manicatus* Haliday. Head, prothorax, antennæ, and legs of female. $\frac{107}{1}$.

15. *Chirothrips manicatus*, end of abdomen of male. $\frac{107}{1}$.

16. *Chirothrips manicatus*, left fore wing of female. $\frac{62}{1}$.

17. *Chirothrips crassus*, new species. Head, prothorax, and antennæ of female. $\frac{107}{1}$.

18. *Chirothrips crassus*, end of abdomen of female. $\frac{107}{1}$.

19. *Chirothrips crassus*, head, prothorax, antennæ, and fore legs of male. $\frac{107}{1}$.

20. *Chirothrips crassus*, end of abdomen of male. $\frac{107}{1}$.

21. *Chirothrips obesus*, new species. Head, prothorax, antennæ, and fore legs of female. $\frac{107}{1}$.

22. *Chirothrips obesus*, end of abdomen of female. $\frac{107}{1}$.

23. *Sericothrips variabilis* (Beach). Left fore wing of female. $\frac{107}{1}$.

PLATE III.

Fig. 24. *Sericothrips variabilis* (Beach). Head, prothorax, and antennæ of female. $\frac{107}{1}$.

25. *Sericothrips variabilis*, end of abdomen of female. $\frac{107}{1}$.

26. *Sericothrips variabilis*, end of abdomen of male. $\frac{107}{1}$.

27. *Sericothrips cingulatus*, new species. Head, prothorax, and antennæ of female. $\frac{107}{1}$.

- Fig 28. *Sericothrips cingulatus*, end of abdomen of female. $\frac{107}{1}$.
29. *Sericothrips cingulatus*, end of abdomen of male. $\frac{107}{1}$.
30. *Pseudothrips inequalis* (Beach). Head, prothorax, antennae, and fore legs of female. $\frac{107}{1}$.
31. *Pseudothrips inequalis*, end of abdomen of female. $\frac{107}{1}$.
32. *Pseudothrips inequalis*, right fore wing of female. $\frac{107}{1}$.
33. *Euthrips nervosus* (Uzel). Head, prothorax, antennae, and fore legs of female. $\frac{62}{1}$.
34. *Euthrips nervosus*, end of abdomen of female. $\frac{62}{1}$.

PLATE IV.

- Fig. 35. *Euthrips nervosus* (Uzel). Right fore wing of female. $\frac{62}{1}$.
36. *Euthrips tritici* (Fitch). Head, prothorax, antennae, and fore legs of female. $\frac{107}{1}$.
37. *Euthrips tritici*, end of abdomen of female. $\frac{107}{1}$.
38. *Euthrips tritici*, end of abdomen of male. $\frac{107}{1}$.
39. *Euthrips tritici*, left fore wing of female. $\frac{85}{1}$.
40. *Euthrips fuscus*, new species. Head, prothorax, antennae, and fore legs of female. $\frac{107}{1}$.
41. *Euthrips fuscus*, end of abdomen of female. $\frac{107}{1}$.
42. *Scolothrips 6-maculatus* (Pergande). Head, prothorax, antennae, and fore legs of female. $\frac{107}{1}$.
43. *Scolothrips 6-maculatus*, end of abdomen of female. $\frac{107}{1}$.
44. *Scolothrips 6-maculatus*, end of abdomen of male. $\frac{107}{1}$.
45. *Scolothrips 6-maculatus*, right fore wing of female. $\frac{107}{1}$.

PLATE V.

- Fig. 46. *Raphidothrips fuscipennis*, new species. Head, prothorax, antennae, and fore legs of female. $\frac{85}{1}$.
47. *Raphidothrips fuscipennis*, end of abdomen of female. $\frac{85}{1}$.
48. *Raphidothrips fuscipennis*, left fore wing of female. $\frac{85}{1}$.
49. *Anaphothrips striatus* (Osborn). Head, prothorax, and antennae of female. $\frac{85}{1}$.
50. *Anaphothrips striatus*, end of abdomen of female. $\frac{85}{1}$.

- Fig. 51. *Anaphothrips striatus*, right fore wing of female. $\frac{85}{1}$.
52. *Aptinothrips rufus* (Gmelin). Head, prothorax, and antennæ of female. $\frac{107}{1}$.
53. *Aptinothrips rufus*, end of abdomen of female. $\frac{107}{1}$.
54. *Aptinothrips rufus* var. *connaticornis* Uzel. Antennæ of female. $\frac{107}{1}$.
55. *Heliothrips femoralis* Reuter. Head, prothorax, antennæ, and fore legs of female. $\frac{62}{1}$.
56. *Heliothrips femoralis*, end of abdomen of female. $\frac{62}{1}$.

PLATE VI.

- Fig. 57. *Heliothrips femoralis* Reuter. Left fore wing of female. $\frac{62}{1}$.
58. *Heliothrips fasciapennis*, new species. Head, prothorax, and antennæ of female. $\frac{107}{1}$.
59. *Heliothrips fasciapennis*, end of abdomen of female. $\frac{107}{1}$.
60. *Heliothrips fasciapennis*, right antenna of female. $\frac{167}{1}$.
61. *Heliothrips fasciapennis*, right fore wing of female. $\frac{85}{1}$.
62. *Parthenothrips dracænæ* (Heeger). Head, prothorax, antennæ, and fore legs of female. $\frac{62}{1}$.
63. *Parthenothrips dracænæ*, end of abdomen of female. $\frac{62}{1}$.
64. *Parthenothrips dracænæ*, portion of reticulation from head of female. $\frac{213}{1}$.
65. *Parthenothrips dracænæ*, left fore wing of female. $\frac{62}{1}$.
66. *Thrips perplexus* (Beach). Head, prothorax, antennæ, and fore legs of female. $\frac{107}{1}$.
67. *Thrips perplexus*, end of abdomen of female. $\frac{107}{1}$.
68. *Thrips perplexus*, left fore wing of female. $\frac{107}{1}$.

PLATE VII.

- Fig. 69. *Thrips tabaci* Lindeman. Head, prothorax, antennæ, and fore legs of female. $\frac{107}{1}$.
70. *Thrips tabaci*, end of abdomen of female. $\frac{107}{1}$.
71. *Thrips tabaci*, left fore wing of female. $\frac{85}{1}$.
72. *Anthothrips niger* (Osborn). Head, prothorax, and fore legs of female. $\frac{62}{1}$.
73. *Anthothrips niger*, end of abdomen of female. $\frac{85}{1}$.
74. *Anthothrips niger*, left antenna of female. $\frac{85}{1}$.

- Fig. 75. *Anthothrips niger*, left fore wing of female. $\frac{62}{1}$.
 76. *Anthothrips verbasci* (Osborn). Head, prothorax, antennæ, and fore legs of female. $\frac{50}{1}$.
 77. *Anthothrips verbasci*, end of abdomen of female. $\frac{50}{1}$.
 78. *Anthothrips verbasci*, left antenna of female. $\frac{85}{1}$.
 79. *Trichothrips beauchii*, new species. Head, prothorax, antennæ, and fore legs of female. $\frac{50}{1}$.

PLATE VIII.

- Fig. 80. *Trichothrips beauchii*, new species. End of abdomen of female. $\frac{50}{1}$.
 81. *Trichothrips ambitus*, new species. Head, prothorax, antennæ, and fore femora of female. $\frac{50}{1}$.
 82. *Trichothrips ambitus*, end of abdomen of female. $\frac{50}{1}$.
 83. *Cyphothrips yuccæ*, new species. Head, prothorax, antennæ, and fore legs of female. $\frac{50}{1}$.
 84. *Cyphothrips yuccæ*, end of abdomen of female. $\frac{50}{1}$.
 85. *Phleothrips pergandeii*, new species. Head, antennæ, prothorax, and fore legs of female. $\frac{50}{1}$.
 86. *Phleothrips pergandeii*, end of abdomen of female. $\frac{50}{1}$.
 87. *Phleothrips uzeli*, new species. Head, prothorax, antennæ, and fore legs of male. $\frac{50}{1}$.
 88. *Phleothrips uzeli*, end of abdomen of male. $\frac{50}{1}$.
 89. *Phleothrips uzeli*, under side of right fore leg of male. $\frac{85}{1}$.
 90. *Phleothrips uzeli*, upper side of left fore leg of male. $\frac{85}{1}$.

PLATE IX.

- Fig. 91. *Phleothrips uzeli*, new species. Head, prothorax, antennæ, and fore legs of female. $\frac{50}{1}$.
 92. *Phleothrips uzeli*, end of abdomen of female. $\frac{62}{1}$.
 93. *Acanthothrips magnafemoralis*, new species. Head, prothorax, antennæ, and fore legs of male. $\frac{50}{1}$.
 94. *Acanthothrips magnafemoralis*, end of abdomen of male. $\frac{50}{1}$.
 95. *Malacothrips zonatus*, new genus and new species. Head, prothorax, antennæ, and fore femora of male. $\frac{50}{1}$.
 96. *Malacothrips zonatus*, end of abdomen of male. $\frac{50}{1}$.

- Fig. 97. *Malurothrips zomatus*, head, prothorax, antenna, and fore legs of female. $\frac{50}{1}$.
98. *Malurothrips zomatus*, end of abdomen of female. $\frac{50}{1}$.
99. *Eurythrips ampliventralis*, new genus and new species. Head, thorax, and fore legs of female. $\frac{62}{1}$.
100. *Eurythrips ampliventralis*, end of abdomen of female. $\frac{62}{1}$.
101. *Eurythrips ampliventralis*, left antenna of female. $\frac{85}{1}$.

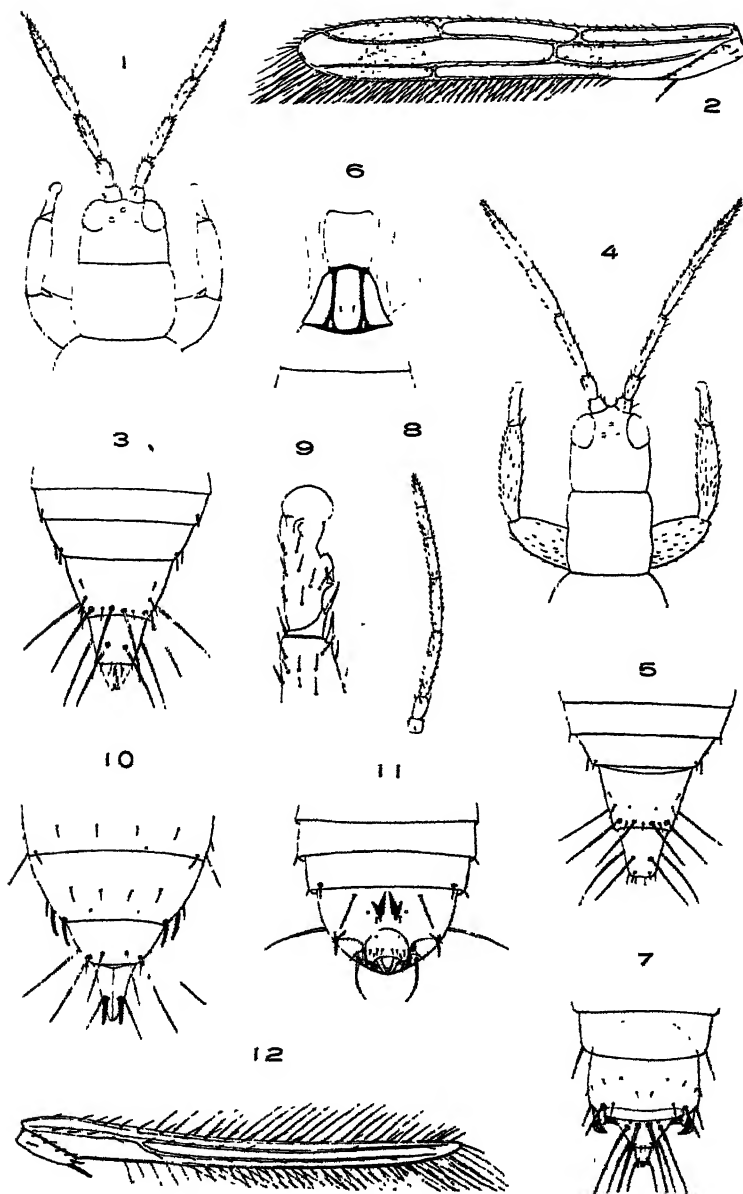
PLATE X.

- Fig. 102. *Eurythrips osborni*, new genus and new species. Head, prothorax, antennae, and fore legs of female. $\frac{62}{1}$.
103. *Eurythrips osborni*, end of abdomen of female. $\frac{62}{1}$.
104. *Cryptothrips aspersus*, new species. Head, prothorax, and fore legs of female. $\frac{50}{1}$.
105. *Cryptothrips aspersus*, end of abdomen of female. $\frac{50}{1}$.
106. *Cryptothrips aspersus*, right antenna of female. $\frac{85}{1}$.
107. *Idolothrips confervarum* Pergande. Head, prothorax and fore legs of male. $\frac{33}{1}$.
108. *Idolothrips confervarum*, end of abdomen of male. $\frac{50}{1}$.
109. *Idolothrips confervarum*, head, prothorax, and fore legs of female. $\frac{33}{1}$.
110. *Idolothrips confervarum*, right antenna of female. $\frac{50}{1}$.
111. *Thrips tabaci*, longitudinal-vertical section through anterior part of body showing form of head and thorax and position of nervous system and alimentary canal. $\frac{83}{1}$.
112. *Anaphothrips striatus*, surface view of stigma from first abdominal segment. $\frac{716}{1}$.
113. *Anaphothrips striatus*, cross section through stigma from first abdominal segment. $\frac{716}{1}$.
114. *Anthothrips verbasci*, under side of last two abdominal segments of male; A, notch in base of tube. $\frac{62}{1}$.
115. *Anthothrips verbasci*, under side of last two abdominal segments of female; A, chitinous rod. $\frac{62}{1}$.

PLATE XI.

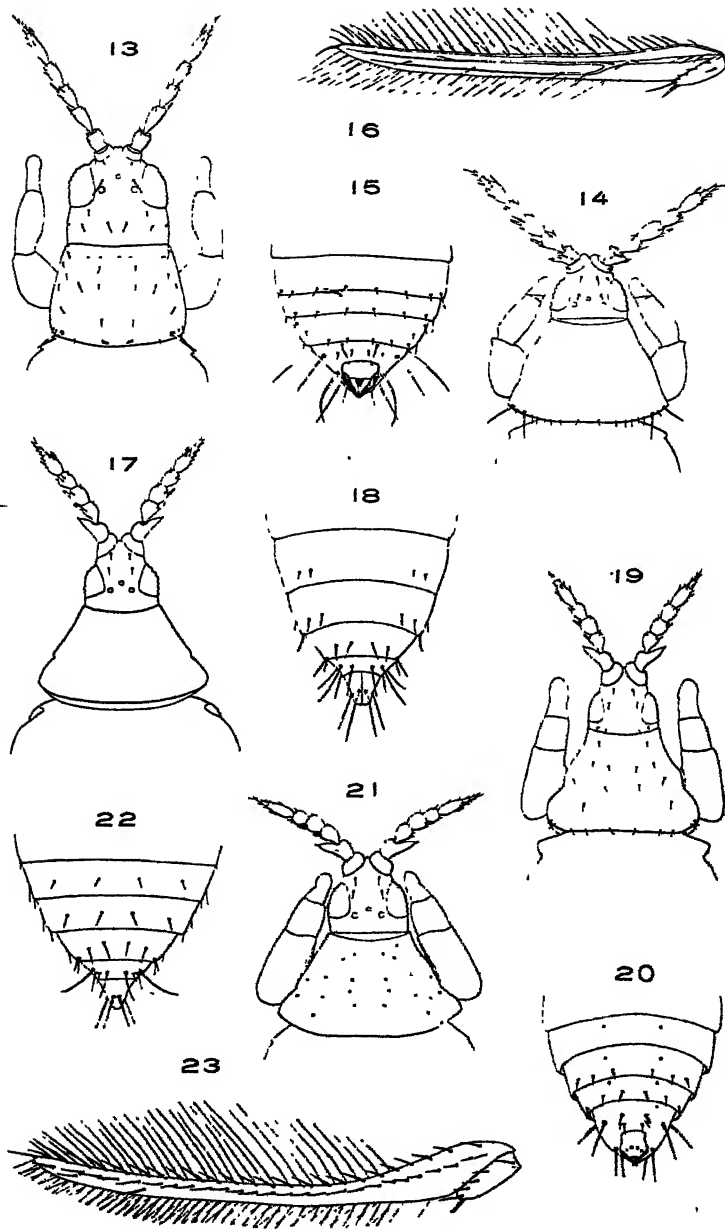
- Fig. 116. *Eolothrips fuscatus*, dorsal view of pterothorax of female. $\frac{62}{1}$. A1, first abdominal tergite; A2, second abdominal tergite; M1, mesoscutum; M2, metascutum; M3, metascutellum.

- Fig. 117. *Eulothrips fusciotus*, ventral view of pterothorax of female. $\frac{62}{1}$. C, coxa; ET, endothoracic invaginations; MS, mesosternum; MT, metasternum; S1, first abdominal sternite; S2, second abdominal sternite; T, trochanter.
118. *Heliothrips femoralis*, dorsal view of pterothorax of female. $\frac{62}{1}$. A1, first abdominal tergite; A2, second abdominal tergite; M1, mesoscutum; M2, metascutum; M3, metascutellum.
119. *Heliothrips femoralis*, ventral view of pterothorax of female. $\frac{62}{1}$. ET, endothoracic invaginations; MS, mesosternum; MT, metasternum.
120. *Amphothrips stratus*, face of female. $\frac{115}{1}$. EC, endocranial thickening at base of mouth cone; LI, labium; LP, labial palpi; LR, labrum; MD, mandible; ML, internal piercing lobe of maxilla; MP, maxillary palpi; MX, maxilla.
121. *Amphothrips stratus*, side view of end of abdomen of female; ovipositor lowered into position for use. $\frac{107}{1}$.
122. *Eulothrips bicolor*, under side of antennal segments two to five. $\frac{213}{1}$. SA, sense areas.
123. *Thrips perpleucus*, upper side of antennal segments two to seven. $\frac{213}{1}$. SC, sense cones.
124. *Trichothrips umbellus*, upper side of antennal segments two to seven. $\frac{130}{1}$. SC, sense cones.
125. *Limothrips arum*, dorsal view of pterothorax of wingless male. $\frac{107}{1}$. A1, first abdominal tergite; A2, second abdominal tergite; M1, mesoscutum; M2, metascutum.
126. *Anthothrips verbascae*, dorsal view of head and thorax of female. $\frac{62}{1}$. A1, first abdominal tergite; A2, second abdominal tergite; M1, mesoscutum; M2, metascutum; M3, metascutellum.
127. *Anthothrips verbascae*, ventral view of head and thorax of female. $\frac{62}{1}$. ET, endothoracic invaginations; MS, mesosternum; MT, metasternum; S1, first abdominal sternite; S2, second abdominal sternite.



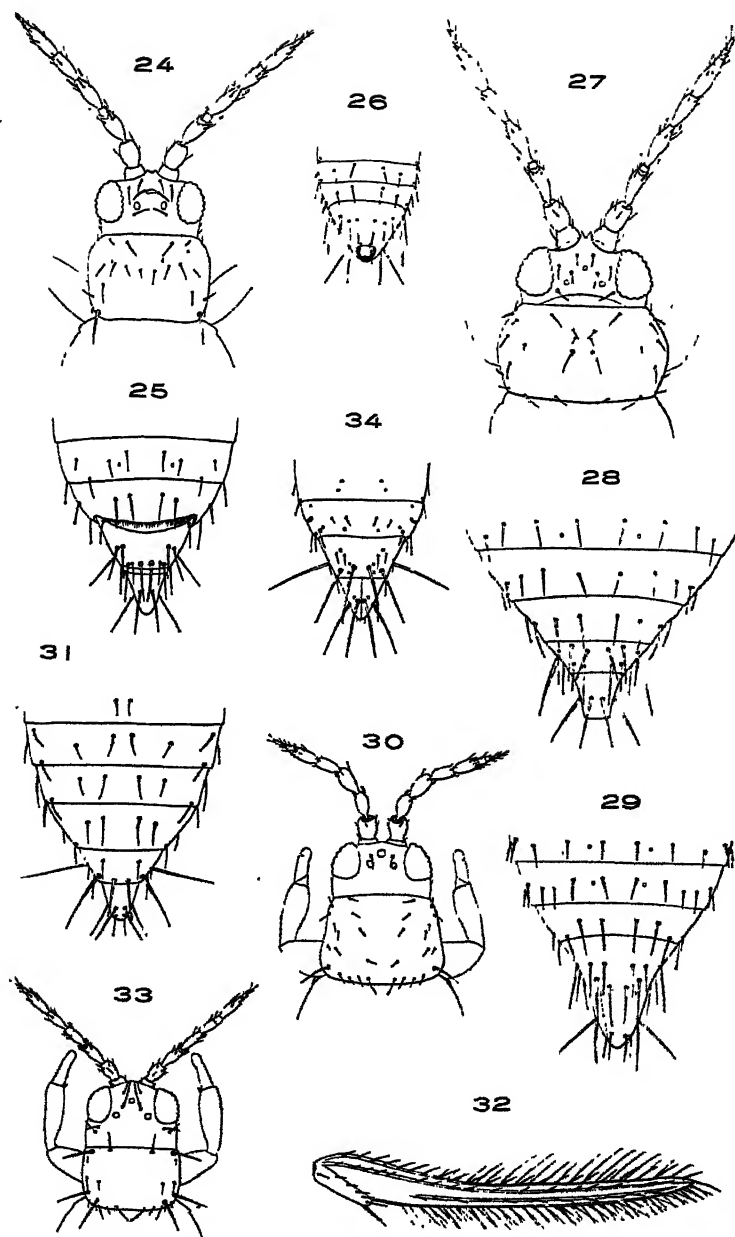
NORTH AMERICAN THYSANOPTERA.

FOR EXPLANATION OF PLATE SEE PAGES 236, 237.



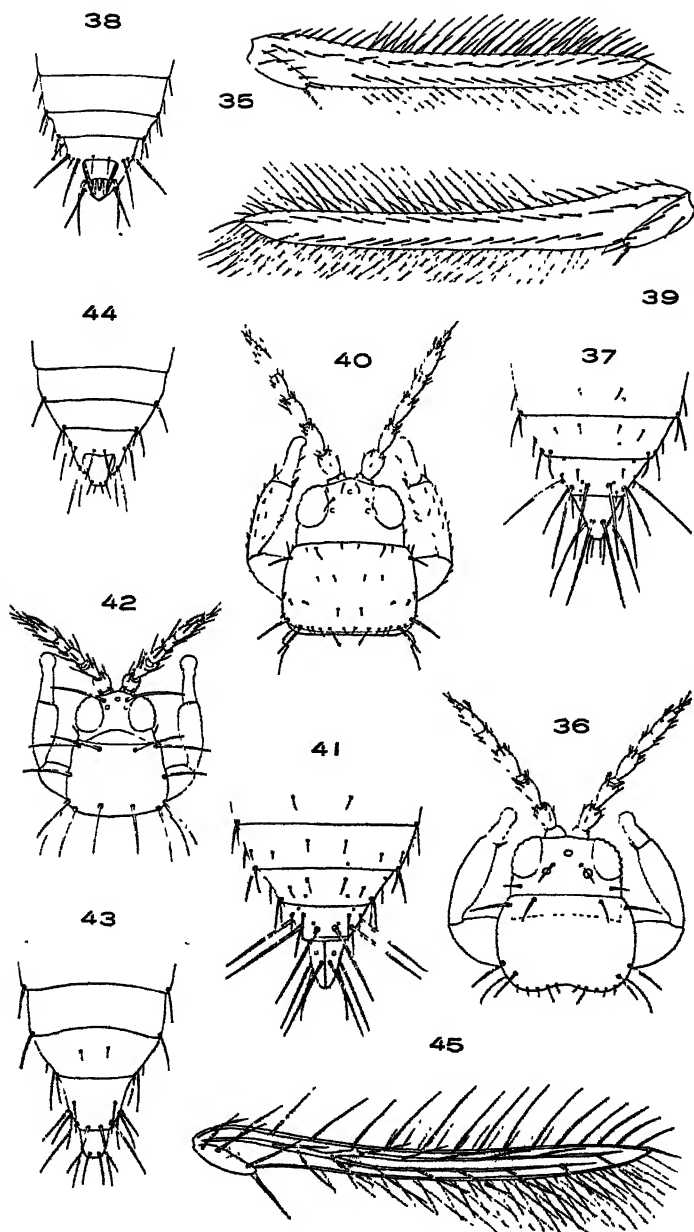
NORTH AMERICAN THYSANOPTERA.

FOR EXPLANATION OF PLATE SEE PAGE 237.



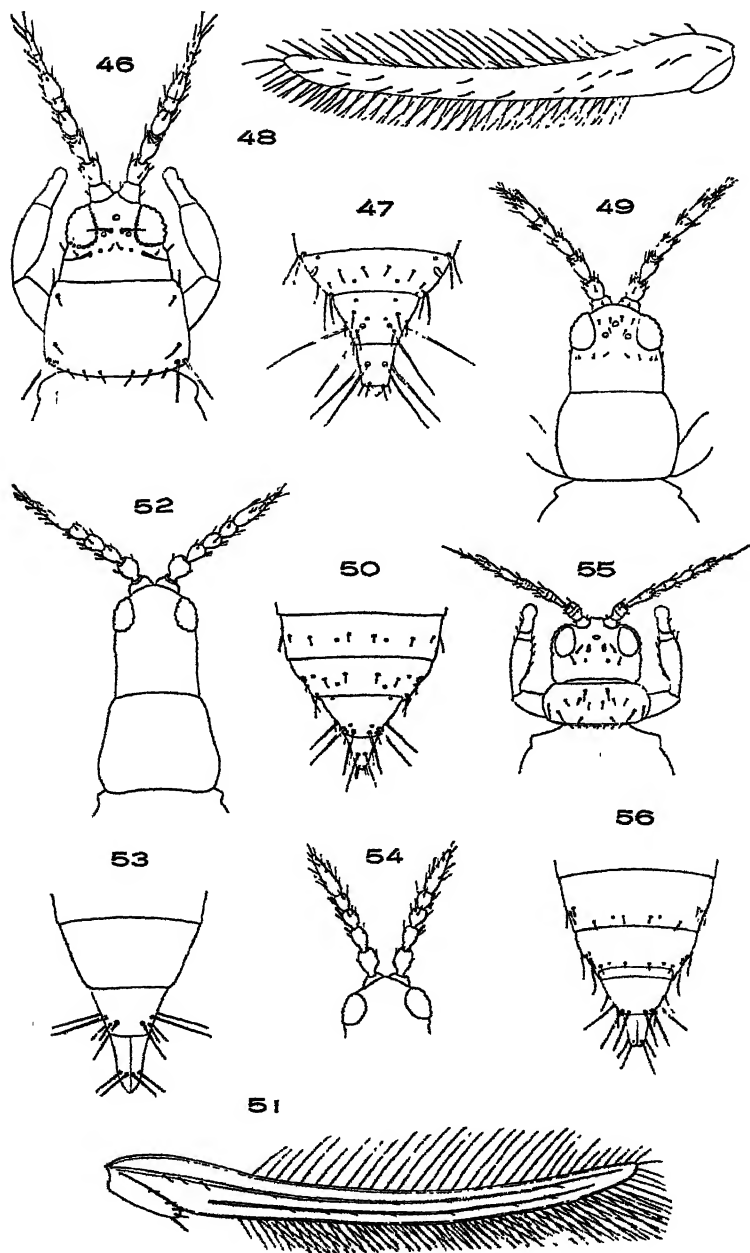
NORTH AMERICAN THYSANOPTERA.

FOR EXPLANATION OF PLATE SEE PAGES 237, 238.



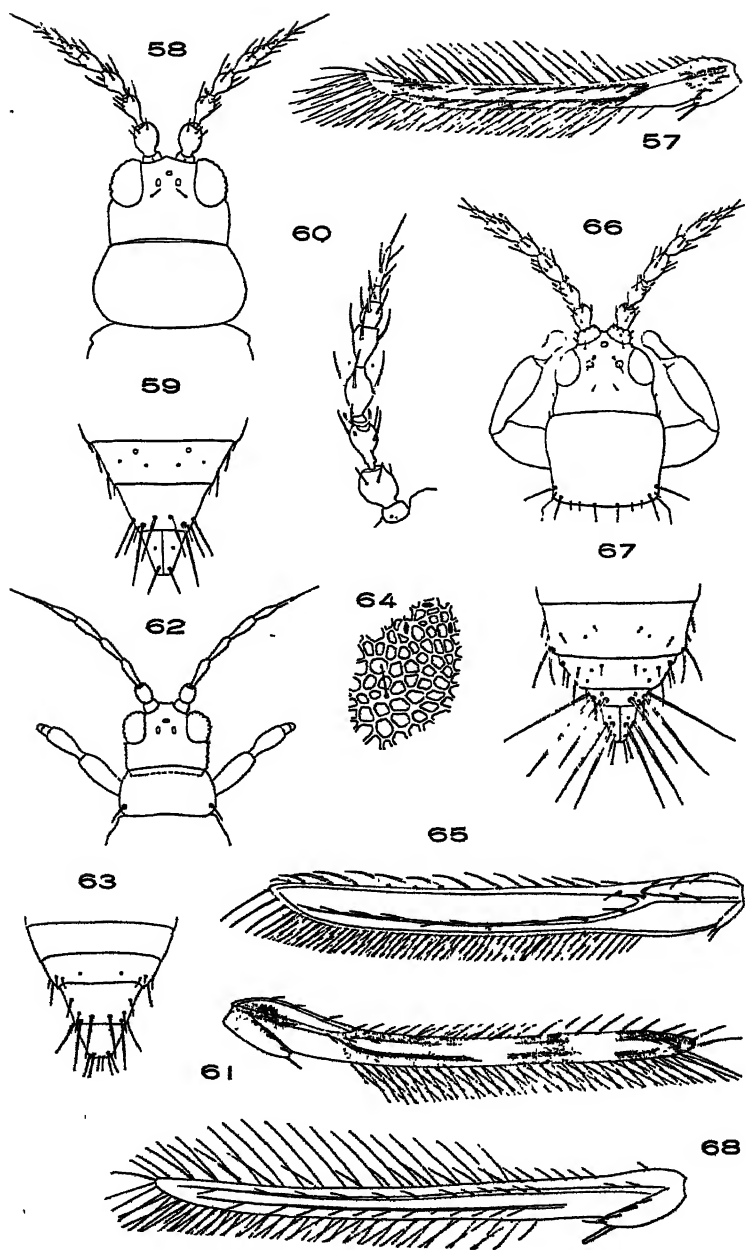
NORTH AMERICAN THYSANOPTERA.

FOR EXPLANATION OF PLATE SEE PAGE 238.



NORTH AMERICAN THYSANOPTERA.

FOR EXPLANATION OF PLATE SEE PAGES 238, 239.



NORTH AMERICAN THYSANOPTERA.

FOR EXPLANATION OF PLATE SEE PAGE 239.

A GENEALOGIC STUDY OF DRAGON-FLY WING VENATION.

By JAMES G. NEEDHAM,
Of Lake Forest College, Lake Forest, Illinois.

INTRODUCTION.

This is a new study of one of the oldest subjects in entomology. It is an application of the methods of comparative morphology to the interpretation of some external characters universally employed in systematic work upon insects.

The richly veined wings of dragon-flies have been carefully studied by many able entomologists; their interesting peculiarities are well known; the homologies of the various parts of the wing have been determined throughout the order; and there already exists a considerable body of evidence as to the nature and extent of variation in venational characters. There has been as yet no serious effort to use these characters to determine genealogic succession within the order. It is the main purpose of this paper to translate the records of natural selection as written in the abundant characters of these wings.

At the outset I wish to acknowledge my indebtedness to the following gentlemen, who have all aided me generously: To Prof. J. H. Comstock, of Cornell University, I am indebted first of all for constant advice throughout the progress of this study; to Mr. Samuel Henshaw, of the Museum of Comparative Zoology, for free use of the Hagen Collection of Odonata during a stay of two months in Cambridge; to Dr. R. T. Jackson, of Harvard University, for similar privileges in the study of the fossil Odonata of the same museum; to Dr. P. P. Calvert, of the University of Pennsylvania, for the loan of valuable specimens; to Monsieur R. Martin, of Le Blanc, for the gift of specimens; and to Dr. S. H. Scudder, for the privilege of examining the types of fossil Odonata in his collection, and also some of his original unpublished drawings.

I. THE ONTOGENY OF THE VENATION.

HISTORICAL.

It is pleasant to find that the first contribution to the knowledge of developing veins was made by Dr. Hagen. In 1846 he published a little paper, a page in length, entitled *Ueber die Bildung des Geäders der Libellen-flügel*.^a In this he wrote that by simply rubbing the expanding wing of a transforming dragon-fly between the thumb and finger the two membranes of the wing may be slipped apart, and it will be readily seen that the venation is double, i. e., developed alike in both membranes, and that the double network thus formed is united and exactly coincident along the courses of the wing tracheæ. At this day one who wishes to see the relation of veins to tracheæ can hardly do better than repeat this simple experiment. Thus he may at least see, a thing too little comprehended hitherto, that the tracheæ passing out from the body cavity into the wing cavity are essentially internal organs as compared with the cuticular (hypodermal) thickenings formed about them constituting the veins.

Oswald Heer appears to have been the first to use the wings of dragon-fly nymphs as an aid to interpreting the homologies of the adult venation.^b He made no use of tracheæ, however, but only of the veins marked upon the exterior of the wing sheath, these being essentially the same as the veins in the adult only served to confirm him in an erroneous interpretation of homologies.

Roster first figured the tracheation of a nymphal wing.^c His figure (of *Æschna cyanea*) was made to show tracheal distribution without reference to venation. It is in several points incorrect, and a chance remark in the text shows that Roster did not perceive the order which exists in the arrangement of the tracheæ.^d

In 1888 Brauer and Redtenbacher published a paper on immature insect wings, using mainly a species of *Æschna* to show the fallacy of Adolph's theory of alternating convex and concave veins.^e Of the

^aStettiner Ent. Zeit., VII, pp. 115-116. A similar paper by Dr. Hagen, *Kurze Bemerkung ueber das Flügelgeäder der Insecten* (Wien. Ent. Zeit., V, pp. 311-312), was called out in 1886 by the theories with which Adolph and Redtenbacher had encumbered their useful works upon the homologies of the wing veins in general. Then in 1889 he published (*Spaltung eines Flügels um das doppelte Adernetz zu zeigen*, Zool. Anz., XI, pp. 377-378) a similar article with a figure, showing the main facts set forth in all these papers.

^bHeer, Oswald, *Die Insectenfauna der Tertiargebilde von Oeningen und von Badoboj in Croatien*, Neue Denkschr. Schweiz. Ges., XI, 1850, Libellulidae, pp. 36-82, pl. iv.

^cRoster, D. A., *Contributo all' anatomia ed alla biologia degli Odonata*, Bull. Soc. Ent. Ital., XVII, pp. 256-268, 2 pls.

^dMandando in questo percorso cinque o sei diramazioni che innervano intrecciandosi in vario modo, la superficie dell'ala. [The italics are mine.—J. G. N.]

^eEin Beitrag zur Entwicklung des Flügelgeäders der Insecten, Zool. Anz., XI, pp. 443-447.

branches of a single main trachea, some were shown to be incorporated into convex and some into concave veins. Thus disappeared the fundamental difference which had been assumed to exist between the two kinds of veins.

Brauer and Redtenbacher also affirmed that the homology of veins in remotely related insects is only to be determined by the study of their development—a suggestion which has until quite recently been generally commended in theory and more generally disregarded in practice.

Brogniart, in his *Etude sur la nervulation des ailes des insectes*,^a figures both the tracheation and the venation in careful detail, and points out the close correspondence between the two. He fails to recognize the individuality of the veins and tracheæ, however, designating mere branches as independent veins, and he confuses the identity of one branch (*Rs*) by giving it a different designation in the two stages.

The foregoing papers have shown (without expressly stating) the following points: (1) The precedence of the tracheæ and the subsequent development of the veins about them, through hypodermal elevations becoming paired troughs, which by fusion become hollow tubes inclosing the tracheæ; (2) the difference in kind, and (3) the correspondence in arrangement between the two structures; and (4) the fact that simpler conditions are found in the earlier stages.

I have traced the development of the venation through a series of nymphal stages and have published recently, in collaboration with Professor Comstock, a preliminary account of it,^b but must for present purposes review the matter more at length.

ONTOGENY IN GOMPHUS DESCRIPTUR.

For the present I pass by all points of histological structure, not as being uninteresting or unimportant, but as being unessential to the specific problem now in hand. I shall deal in this paper with facts that may be observed without the aid of sections, and, for the most part, with no special preparation whatever.^c

Six principal tracheæ traverse the wing of a dragon-fly in all stages. These arise very early in the budding wing, springing separately from a longitudinal thoracic tracheal trunk which makes a slight bend outward to meet the base of the wing. These tracheæ and their cor-

^a *Recherches sur les insectes fossiles*, etc., Paris, 1894. See especially pp. 204–208, and pl. viii.

^b Comstock, J. H., and Needham, J. G., *The Wings of Insects*, Amer. Nat., XXXII and XXXIII, 1898 and 1899; Art. Odonata, XXXII, pp. 903–911, 9 figs.

^c The only preparation necessary to demonstrate the facts cited in the following pages is that of the wings of nymphs, which should be removed fresh, mounted quickly in glycerin jelly, and cooled suddenly (to retain the air in the tracheæ), and are then ready for observation.

responding veins will be designated, beginning at the anterior margin of the wing, by the following names and abbreviations:

- | | |
|---------------------------|----------------------------|
| 1. <i>Costa</i> (C.). | 4. <i>Media</i> (M.). |
| 2. <i>Subcosta</i> (Sc.). | 5. <i>Cubitus</i> (Cu.). |
| 3. <i>Radius</i> (R.). | 6. <i>Anal veins</i> (A.). |

Typical branches will be designated by added numerals (as M_1 , M_2 , M_3 , and M_4 , designating from front to rear the branches of the media), except the posterior division of the radius, which has received the special name of "radial sector" (R_s). Accessory and secondary branches will be designated by small letters added in the order of the development of the branches (as R_{sa} , R_{sb} , R_{sc} , etc., for the secondary branches of the radial sector).

Fig. 1 represents the tracheæ in two early stages of the development of the nymphal wing of *Gomphus desertus*. A is from a nymph less than one-fourth grown, the wing 1 mm. long. The tracheæ so closely resemble those in the developing wings of insects of many other orders there can be no doubt as to their homology. The radial sector is

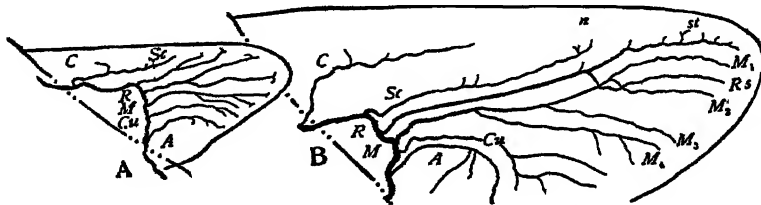


FIG. 1.—TRACHEATION OF THE WINGS OF TWO NYMPHS OF *Gomphus desertus* BANKS, TWO EARLY STAGES. FOR EXPLANATION OF LETTERING SEE TEXT, ALSO, n = NODUS AND st = SUPERTRIANGLE.

simple—it is generally branched in other orders—and there is a single anal vein. In other orders there are oftenest three.^a Otherwise the tracheæ are entirely typical at this stage. It is worthy of note that at this stage the wing is somewhat bilaterally symmetrical and the tracheæ are of almost equal size and length.

Fig. 1. B is from an older nymph with wings 3 mm. long. The two marginal tracheæ are reduced or, rather, outstripped by their competitors, the wing has become quite unsymmetrical, and the radial sector has come to lie across the distal end of the media.

Fig. 2 represents the tracheation of both fore and hind wings of a grown nymph of the same species. The costal trachea is so dwarfed as hardly to enter the costal vein. The radial sector lies back of the two anterior branches of the media which it crosses. The other tracheæ, also, are assuming their definitive positions, and some of them are becoming strongly angulated at the middle and toward the base of the wing.

These three stages show clearly how the primitive insect wing has

^a Probably the three terminal branches of this trachea represent the typical first, second, and third anal tracheæ fused together.

been modified to produce the Odonate type, in which the most anomalous thing is the crossing of the radial sector over two branches of the media. I can not now suggest even a possible reason why this should have taken place. It is apparently a character quite distinctive of the order Odonata.

A photograph of fore and hind wings of a grown nymph of the same species, showing the tracheæ and the veins together as they appear during the last nymphal stage, is reproduced in Plate XXXI, fig. 1. This will assist greatly in comparing the adult wings shown in fig. 3 with the preceding figures. This also shows that certain well-known features of the dragon-fly wing are due to strong cuticularisation

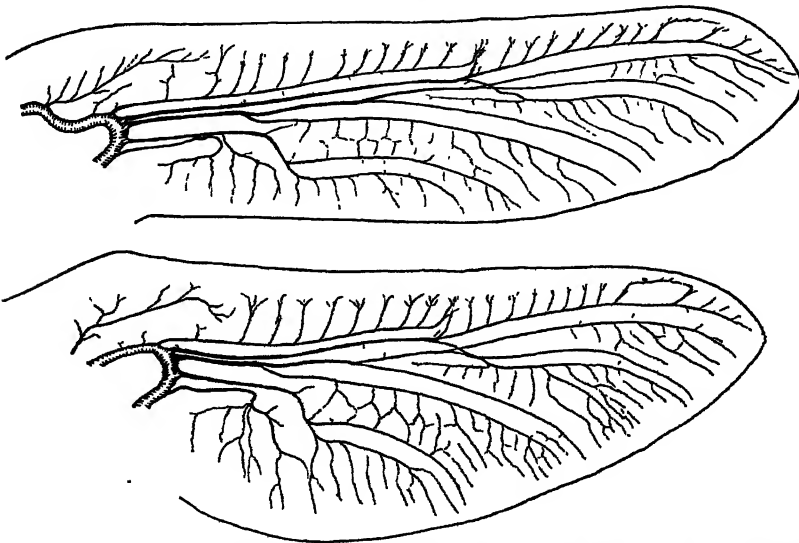


FIG. 2.—FORE AND HIND WINGS OF A GROWN NYMPH OF *Gomphus dracriptus*, SHOWING TRACHEÆ. THE PERMANENT VENATION WHICH SHOWS DISTINCTLY AT THIS STAGE IS OMITTED.

between the tracheæ. Such are the stigma (*st.*), the nodus (*n.*), and parts of the arculus (*ur.*) and triangle (*t.*).

The radial sector.—In the adult wing (fig. 3) the radial sector appears to be a branch of the media. It has always been so interpreted. The only indication of its connection with the radius is the persistent obliquity of an apparent cross vein between veins M_2 and Rs . This is in fact not a cross vein, but a part of the radial sector, while the longitudinal trunk (*br.*) extending proximally from this point to connect vein Rs with vein M_{1+2} ^a is not homologous with any principal vein, but is a secondary structure developed for mechanical advantage. There will be seen in the plate a recurrent tracheal twig preceding this structure.

^aThe plus sign is thus used as a convention for indicating united branches or tracheæ, the numerals it connects designating the branches conjoined.

Arculus and triangle.—The radius and the media tend from the first to unite at the base, and in the adult wing appear to form a single vein as far as the arculus. But even in the adult wing this vein may be seen, as pointed out by Brogniart, to be composed of two, whose union he aptly compared to that of the barrels of a gun. Media suddenly bends away from the radius and is met by a cross vein from the cubitus, and thus the arculus is formed. A similar deflection of the cubital tracheæ just beyond the arculus makes a place for the development of the triangle, which is completed by two cross veins approximated upon vein M_1 . Thus only the upper end of the arculus and the inner side of the triangle are formed from principal veins.

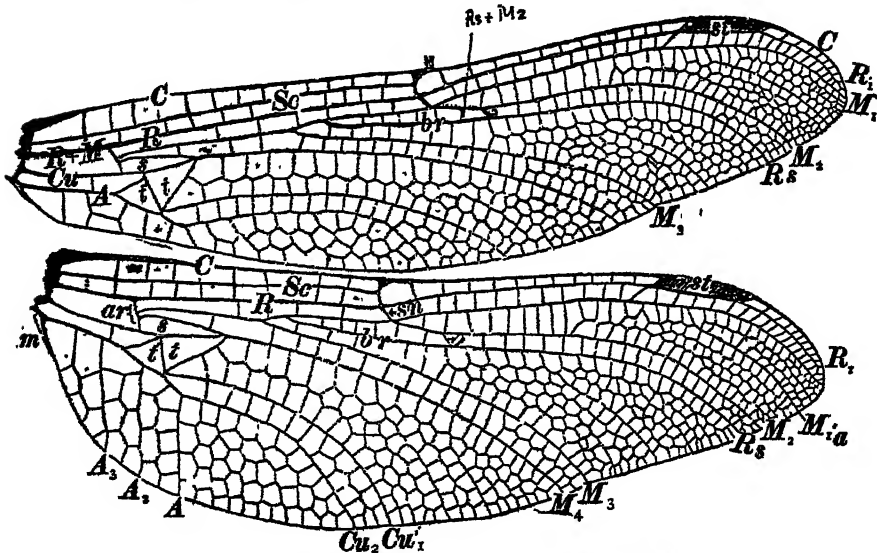


FIG 3.—VENATION OF THE IMAGO OF *Gomphus desertus*.

Tracheæ and cuticular thickenings thus combine to produce a unique insect wing, whose chief peculiarities arise from three transverse unions of its veins, at stigma, nodus, and arculus, respectively. Added to the usual thickening of veins and corrugation of membrane at the front border, these three unions make the part of the wing which cuts the air and supports other parts very strong. It will be observed that at the stigma but two or three veins are thus conjoined, at the nodus, more, and at the arculus (by means of parts accessory to the arculus) all the principal veins are bound together across the basal part of the wing. A line drawn from the outer end of the stigma to the hind angle of the triangle divides the wing into two areas, the anterior of which includes the strong framework of the wing, while the other is yielding membrane with weak venation, adapting the wing for that rapid sculling action in air by which forward motion is produced.

II. THE STUDY OF THE WING BY AREAS.

These three points of transverse bracing are also the points about which have played the forces which have evolved the dragon-fly wing. They are the points about which one can best follow the shifting of veins and tracheæ. In a study of genealogy one can hardly do better, therefore, than to discuss the wing by areas with these points as centers, drawing freely upon ontogeny, comparative anatomy, and paleontology for evidence of the changes that have taken place.

THE AREA OF THE STIGMA.

The stigma is developed upon the cutting edge of the wing at the point of greatest impact against the air. It would seem to serve the

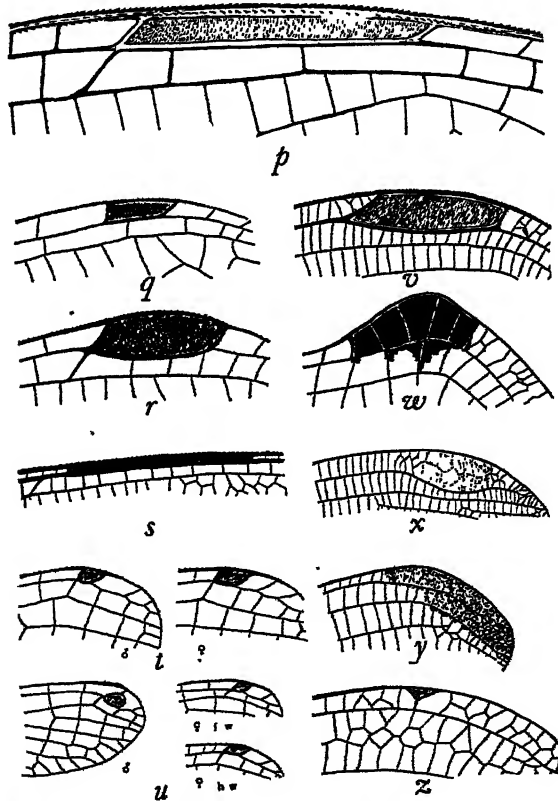


FIG. 4.—PTEROSTIGMAS; *p*, OF *Anax junius* DRURY; *q*, OF *Mithyria marcella* SELYS; *r*, OF *Neogomphus molestus* SELYS; *s*, OF *Uropetala carovei* SELYS; *t*, OF *Agrion mercuriale* CHARPENTIER; *u*, OF *Anomalagrion hastatum* SAT; *v*, OF *Thore gigantea* SELYS; *w*, OF *Mecistogaster lucetia* DRURY; *x*, *Calopteryx maculata* BEAUVOIS; *y*, *Microstigma* sp?; *z*, *Microstigma rotundatum*, SELYS, HIND WING.

double purpose of firmly uniting the veins of the front margin and of increasing the efficiency of the wing stroke by adding weight at this

striking point. Its shape and extent vary considerably and are often characteristic of groups; but the stigma seems not to contain in itself such characters for the critical determination of the course of specialization as are furnished by surrounding parts.

In the wings of the more generalized members of several families of Odonata there is between veins R_1 and M_1 a series of cross veins, several of which fall directly under the stigma, and all of which are nearly or quite perpendicular to the veins they connect. One of these cross veins which happens to lie at the proximal end of the stigma waxes stronger than its fellows, and is set in an oblique position in such way as to strongly brace the stigma against vein M_1 . Three not remotely related Gomphinae will illustrate the stages in the development of this strong brace from an ordinary cross vein. In *Epigomphus paludosus* (fig. 8) the proximal end of the stigma has no cross vein exactly in line with it; in *Cyclophylla diphylla* (Plate XXXIV, fig. 1) it is in line, but little strengthened; but in *Gomphus dilatatus* (Plate XXXIII, fig. 1) it has become a strong and evident brace. A parallel series might be pointed out among the Aeschninae (compare such genera as *Staurophlebia* (Plate XXXIX, fig. 2), *Basiaeschna* (Plate XXXVII, fig. 2), and *Gynacantha* (Plate XXXIX, fig. 3), and the Agrioninae offer another parallel, with the addition of an interesting feature, which is illustrated by a series of such genera as *Lestes* (Plate LIII, fig. 1), *Philogenia* (Plate LIII, fig. 4), *Argia* (Plate LIII, fig. 5), and *Nehalennia* (Plate LIV, fig. 8). In this series there is the same development of a brace from a cross vein; and, correlated therewith, a progressive angulation of vein M_1 at the base of this cross vein, forming a triradiate brace at that point.

An entirely different method of bracing the front of the wing at the stigma has prevailed in a few forms (*Thore*, fig. 4, *v*, etc.). The cross vein below vein R_1 is not utilized, but the two veins bounding the proximal and posterior sides of the stigma are deflected so as to meet vein R_1 in a strong Y-shaped brace, which, doubtless, serves a purpose analogous to that served by the other triradiate brace described above.

Fig. 4 shows at *p* the normal stigma of *Anax junius*, greatly enlarged. It shows, also, a few common forms of stigma, both braced and unbraced (*q* to *t*), and a few uncommon and more or less degenerate forms (*w* to *z*), which will be discussed under another heading.

THE REGION OF THE NODUS.

Here at once we come upon very peculiar wing features.

The nodus is the stout cross vein near the middle of the costal border of the wing, joining the costa, the subcosta, and the radius. It is traversed by a more or less evident suture, making a flexible and elastic joint which, without loss of strength in the parts which need

rigidity, would seem to allow more effective flexion of the distal parts of the wing.^a

We have already seen the trachea *Rs* descending at the nodus and crossing tracheæ M_1 and M_2 . The veins formed about these tracheæ bind them all solidly together. For convenience of reference we now designate that portion of the radial sector which unites the lower end of the nodus with the median vein as the *subnodulus* (*sn.*) and the short oblique portion of the radial sector appearing as a cross vein behind vein M_2 as the *oblique vein* (*o*), and the trunk secondarily developed to connect the radial sector proximally with vein M_{1+2} as the *bridge* (*br*).

In the suborder Anisoptera we may then note that the radial sector fuses with vein M_2 for a little way, carrying the oblique vein a variable distance beyond the subnodus. The bridge is outlined in tracheæ of two very different types, which are almost characteristic of the two families of the suborder. (1) In all the *Æchninæ* of which I have had nymphs for examination the antecedent trachea is simple, and springs from the radial sector near what will be the distal end of the bridge (fig. 5) and extends in a direct line proximally toward vein M_{1+2} . (2) In most *Libellulidæ* the trachea which precedes the bridge springs from the radial sector near the origin of the latter (fig. 6), descends to the level of the bridge that is to be, forks, and sends its branches in opposite directions to meet veins M_{1+2} and *Rs* respectively. In the *Macromiinæ*, however, it is formed by a modification of the latter type, as shown for *Didymops transversa* in fig. 7 A. Fig. 7 B shows how, by a further division of the radial sector near its base, two oblique veins are formed in the *Cordulegasterinæ* and *Petalurinæ*. Compare also with fig. 28.

In the suborder Zygoptera, so far as known to me, trachea *Rs* appears as a branch of the media, the subnodus, while formed in the usual place, being destitute of a tracheal trunk. The Zygopterous nymphal wing figured herewith (Plate XXXI, fig. 2) shows that the trachea *Rs* has, in this (well grown) stage, at least, no direct communication with the radius at all. But if we compare the adult wings of the two suborders there can be no question as to the identity of the vein *Rs*, or of its homology in the two groups.

The explanation of this at first rather surprising state of the tracheæ I believe to be that the trachea *Rs* has been detached from the radius and attached to the media. There are everywhere between the principal tracheæ open channels of communication, formed by the

^a This suture seems to have cut off the subcostal trachæa, or else to have dwarfed and diverted its tips. In the cicada the subcostal trachea crosses the nodal suture; and doubtless it once did so in Odonata, for the adult vein extends a little way beyond in three living genera of *Æchninæ* (compare *Staurophlebia*, Plate XXXIX, fig. 2), and was well developed beyond in the fossil genus *Æschmidium*. The nodus when present in other orders is nearer the wing apex than in the Odonata.

universal anastomoses of the smallest tracheoles. Any one of these



FIG. 5.—TRACHEATION OF THE NODAL REGION OF THE NYMPHAL WING OF *Anax junius* DRURY.

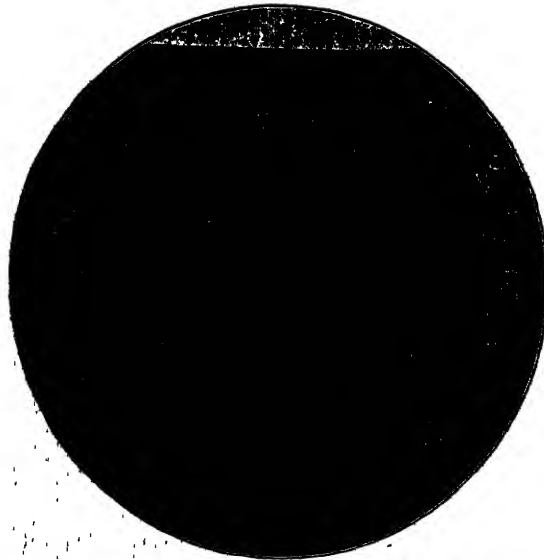


FIG. 6.—TRACHEATION OF THE NODAL REGION OF THE NYMPHAL WING OF *Libellula pulchella* DRURY.

when air passages might become enlarged, should necessity arise for

the entrance of the air from a new quarter. And I think that in this case the necessity may have arisen from the thinning of the wing cases of the slender Zygoptera, whereby the communication of the radial sector with the radius would be gradually pinched off. With the decrease of the air supply from the original source an increased amount must needs come from the medial trunk through tracheoles, some of which would be enlarged and one of which might finally attain the proportions of a tracheal branch, while the base of the radial sector would atrophy.^a

Either the attachment of the radial sector to media was made at three

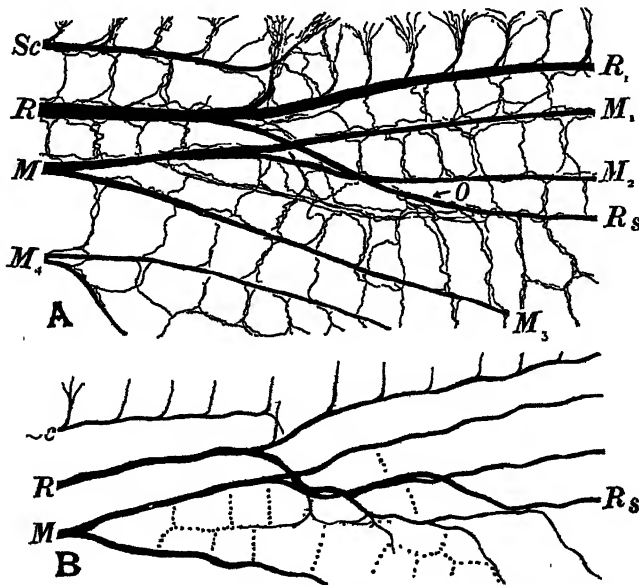


FIG. 7.—TRACHEATION OF THE NODAL REGION OF THE WING. A, OF *Didymops transversa* SAY; B, OF *Cordulegaster illustratus* SELTS, THE LATTER SHOWING THE MODE OF ORIGIN OF THE TWO OBLIQUE VEINS CHARACTERISTIC OF THE CORDULEGASTERINÆ AND PETALURINÆ.

different places, or else, since its reattachment, it has taken a different course in each of three different series within the suborder Zygoptera. In the Lestiniæ we find it separating from vein M_2 far beyond the subnodus, the point of its departure marked by a more or less evident oblique vein, and a long bridge formed about numerous approximated tracheoles, mainly derived from neighboring branches of the media. In the Agrioninæ (*s. str.*) it separates from vein M_{1+2} near the nodus, and there is neither bridge nor oblique vein. In Calopteryx it sepa-

^a Such shiftings of tracheal branches in insects wings are not unprecedented. Another instance will be cited further on in the case of the branches of the anal trachea. A case of the attachment of trachea M_1 to the radius in *Pieris* has been clearly indicated by Spuler (Zeitschr. f. Wiss. Zool., LIII, 1892, fig. 24, and Enderlein (Zool. Jahrb., Abt. f. Anat., XVI, 1902, pl. III, fig. 20.)

rates from vein M_{1+2} far to the proximal side of the nodus, and about in the more usual position of the proximal end of the bridge.^a In this group bridge and oblique vein are lost; but similar parts are found, as will be noted later, extending the attachment of the radial sector to the media still nearer the arculus.

THE REGION OF THE ARCULUS.

Across the base of the wing a strong transverse union of all the principal veins is effected by means of arculus in the middle, triangle at the rear, and antenodal cross veins at the front. Distinct tracheal twigs precede the antenodals of the first (costal) series, while those of the second (subcostal) series are of independent cuticular origin.^b Specialization is to be traced among these cross veins in their reduction in number and matching in position in the two series, and in the hypertrophy of some of them to form stout triangular trusses, which entirely fill, in section, the furrow between the costa and the radius. Two antenodals, some distance apart, are thus hypertrophied in most *Æschnidæ*, one at either side of the arculus; in the *Thorinæ*, but one, and that one meeting the arculus; in *Synthemis* alternate antenodals are thickened, but to a less degree. Their reduction in numbers will be discussed under the general subject of "cross veins."

We have already seen that arculus and triangle are formed where bends in the media and the cubitus, respectively, are met by strong cross veins. We have seen that the medial and the cubital tracheæ are at first straight or slightly curved as in other insects, and that the bending takes place late in nymphal life, at the time when the veins are forming. The genus *Anax* (Plate XL, fig. 3), while highly specialized in many ways, has preserved a rather primitive condition of the arculus. It is composed here largely of cross vein, which the media bends but slightly to meet, and the veins M_{1+2} and M_4 depart from it in straight lines. Media tends to descend the arculus, and the veins M_{1+2} and M_4 , departing from it, become arched strongly toward the radius. In the *Libellulidæ* the branches of the media become fused at the base while arching upward. This may be traced in the stages attained by such genera as *Neocordulia* (Plate XLII, fig. 1), *Raphismina* (Plate XLIV, fig. 3), and *Pachydiplax* (Plate XLVII, fig. 1). The

^a Indicating that in this group at least a recurrent tracheole, such as precedes the bridge in the *Æschnidæ*, may have developed into the basal attachment of the radial sector to the media.

^b In other orders of insects cross veins are generally wanting from this space, and where present are very few in number.

It will be observed that the tracheal twigs which precede the antenodals of the first series are derived from the subcosta; those of the antenodals of the first series, from the radius. These tracheal branches are clearly the homologues of the longer posterior branches of the subcosta and the radius in the Neuroptera and the *Libellulidæ*.

upward arching of the medial branches reaches its climax in some Calopteryginae, when M_{1+2} after separating from M_3 again rejoins the radius; its basal part then appears as a cross vein, and when its trunk again frees itself it appears as a branch of the radius. *Pseudophaea* (Plate LII, fig. 3), *Calopteryx* (fig. 34), and *Vestalis* (fig. 41) have preserved the steps by which such condition has been attained.

In *Epigomphus* (fig. 8) there is a curious tendency for these medial branches to become conjoined just after their separate departure from the arculus.

In all these tendencies cuticularisation outruns tracheation; the veins become sharply angulated; the tracheae much less so. This will be clearly seen by comparing nymphal (Plate XXXII, figs. 2 and 3) and adult (Plate XXXV, fig. 3) wings of *Lanthus parrulus*.

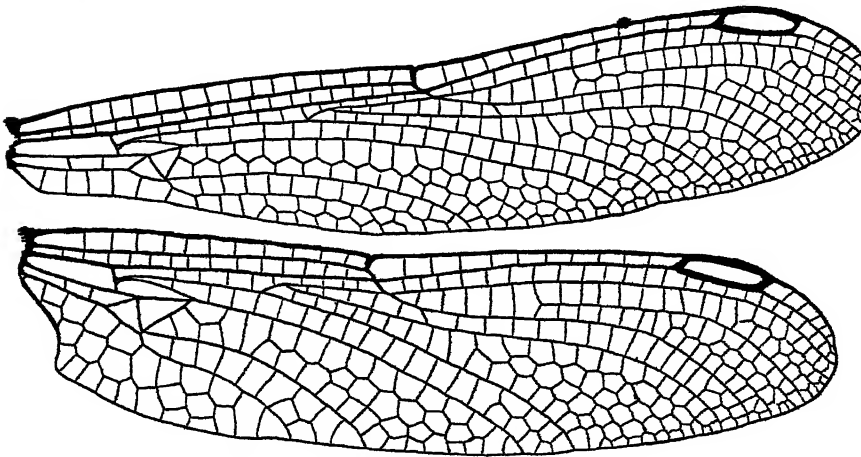


FIG. 8.—WINGS OF *EPIGOMPHUS PALUDOSTUS* SELYS.

The triangle has been called by several writers the "cardinal cell," and worthily, for it is a feature of cardinal importance in the Odonate wing.^a We have already observed that it is ordinarily formed in *Gomphus* and others of the suborder Anisoptera, between an oblique deflected portion of the cubitus and two cross veins approximated upon the hindmost branch of the media. Between the proximal one of these two cross veins and the arculus is a narrow space which may conveniently be termed the "supertriangle" (s., of all the figures; also called elsewhere "supratriangular space").

The quadrangle of the Zygoptera.—In the suborder Zygoptera triangle and supertriangle bear different relations to each other and to surrounding parts of the wing. Together they constitute a unit of wing structure. They are placed in line, not directed apart by an

^a It is not always triangular, but the exceptions are few. The name is a very convenient one and in general use, and I use it in a strictly technical sense without regard to shape.

obtruding angle of the cubitus, and are oftenest confluent through the atrophy of the middle cross vein. To the four-sided figure, which together they always present, we will apply the technical term "quadrangle" (*q*), of all the figures; also called elsewhere "quadrilateral, and

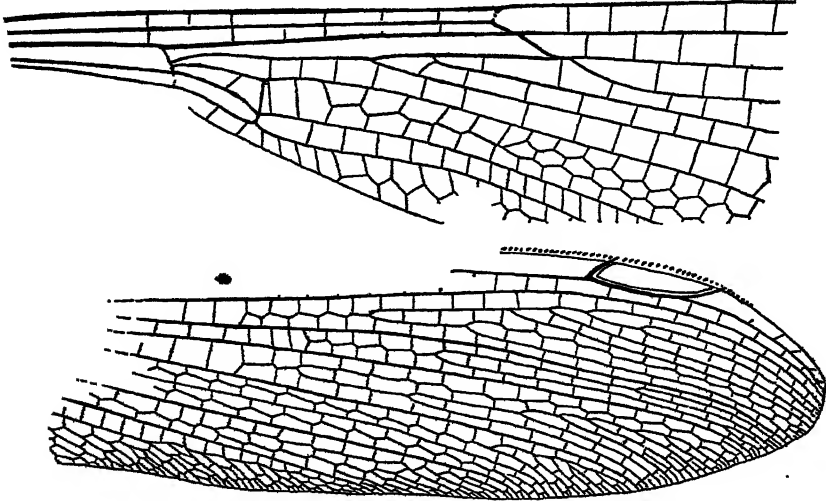


FIG. 9.—WINGS OF A FOSSIL, UNDESCRIBED, AGRIONID GENUS, IN THE MUSEUM OF COMPARATIVE ZOOLOGY.

quadrangular space"). The fossil Agrionid genus illustrated in fig. 9 offers easy transition from the conditions just seen in the Anisoptera to those of the Zygoptera, and renders homologies plain. Comparing this wing with the fore wing of *Tetrathemis* (fig. 10) with respect

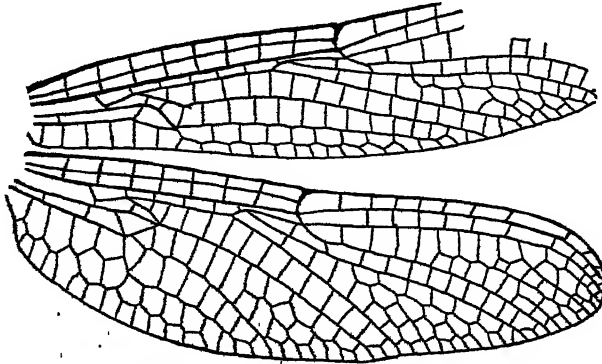


FIG. 10.—WINGS OF *Tetrathemis hyalina* KIRBY.

In the points in question, triangle and supertriangle are recognizable readily in both (though in *Tetrathemis* the latter is elongated and confluent with the cross vein), and both may easily be derived from ordinary

In Agrionidae (Plates LIII and LIV) the quadrangle is undivided, the middle cross vein being absent. In the Calopterygidae (Plate LII) the middle cross vein is occasionally wanting, as in *Anisopleura* and *Epallage*, but in general the quadrangle is elongated and contains numerous extra cross veins, among which the identity of the typical one is lost. The quadrangle is generally rectangular in this family, but in *Heterina* (Plate LI, fig. 4) it is widened distally and convex anteriorly; in *Thore* (fig. 35) and its allies, exactly the reverse. These facts are illumined when one sees what has been the behavior of the cross vein which terminates the quadrangle in this family. Vein Cu_2 , separating from vein Cu_1 at a right angle, and as suddenly bending again distally, sets off a transverse basal portion which is in direct line with this cross vein. The two thus joined rotate together about the hind angle of the triangle as an axial point, while the two forms of quadrangle described above are developing. In *Heterina* (Plate LI, fig. 4) and *Lais* the medial end of the cross vein has proceeded distally, while the base of Cu_2 has been retracted; in *Thore* (fig. 35), *Rhinocypha*, *Lestes*, etc., the reverse rotation has taken place, as illustrated in the accompanying diagram (fig. 11).

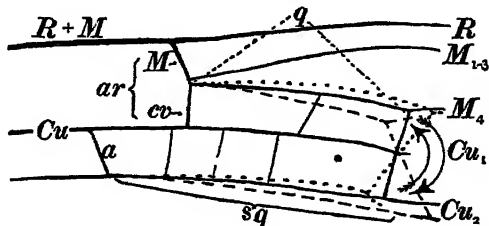


FIG. 11.—DIAGRAM ILLUSTRATING THE BEHAVIOR OF THE QUADRANGLE IN THE CALOPTERYGIDÆ. SOLID LINES, A SOMEWHAT PRIMITIVE QUADRANGLE; LINE OF DOTS, THE QUADRANGLE OF *Heterina*. LINE OF DASHES, THAT OF RHINOCYPHA; ARROWS INDICATE THE OPPOSITE COURSE OF ROTATION. COMPARE WITH PLATES LI AND LII.

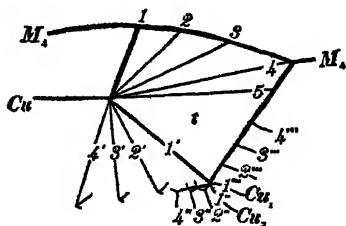


FIG. 12.—DIAGRAM SETTING FORTH THE BEHAVIOR OF THE TRIANGLE IN THE SUBORDER ANISOPTERA. THE HEAVY LINES BOUND A SOMEWHAT PRIMITIVE TRIANGLE. 1, 2, 3, 4, AND 5 ARE STAGES IN THE DESCENT OF THE UPPER CROSS VEIN. 1', 2', 3', AND 4' REPRESENT SUCCESSIVE STAGES IN THE RETRACTION OF THE CUBITUS AT THE TRIANGLE. 1'', 2'', 3'', AND 4'' REPRESENT STAGES IN THE RETRACTION OF THE BASE OF VEIN (Cu_2). 1''', 2''', 3''', AND 4''' REPRESENT STAGES IN THE ASCENT OF THE VEIN Cu_1 UP THE OUTER SIDE OF THE TRIANGLE.

and to follow the shiftings of its parts severally.

1. *The angulation of the cubitus.*—At the dividing cross vein of the quadrangle, the cubitus tends in all Anisoptera to form an angle, which pushes triangle and supertriangle out of line, thus destroying the unity of the quadrangle, in making of it two elements of wing

The triangle of the Anisoptera.—Returning now to the suborder Anisoptera, and to the triangle as an individual feature of the wing, we may follow with the aid of fig. 12 the changes that have taken place in it, bringing it from the condition of an ordinary rectangular cell to its present estate. It will be convenient to begin with a triangle hardly more generalized than that of the fore wing of *Tetrathemis*,

structure. The increasing angulation at this point may be followed in the fore wings of a series of Libelluline genera, such as *Microdiplax* (fig. 13), *Anatya* (Plate XLIV, fig. 2), *Mesothemis* (Plate XLV, fig. 3), and *Perithemis* (Plate XLIII, fig. 3). It is only a little less evident in such Gomphine genera as *Agriogomphus* (fig. 27), *Gomphoides* (Plate XXXIII, fig. 2), and *Gomphus* (Plate XXXIII, fig. 1). It will be observed that this deflection of the cubitus results in the widening of the space between veins M_1 and Cu_1 beyond the triangle. This may be seen in the aforementioned genera.

2. *The deflection of the middle cross vein of the quadrangle.*—It is this process that makes the distal half of the quadrangle triangular. Successive positions of the cross vein are shown at 1, 2, 3, 4, and 5 of figure. Such genera as *Tetrathemis* (fig. 10), *Anatya* (Plate XLIV, fig. 2), *Macrothemis* (Plate XLVI, fig. 1), and *Ephidratia* (Plate XLVII, fig. 2) exhibit these stages. A similar but less striking series will be seen in such Gomphine genera as *Agriogomphus* (fig. 27),

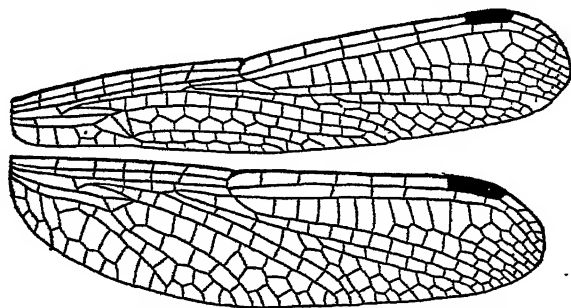


FIG 13.—WINGS OF MICRODIPLAX DELICATULA SELYS.

Gomphoides (Plate XXXIII, fig. 2), and *Hagenius* (fig. 23). This cross vein has become greatly elongated in most *Æchnidæ*, resulting in the elongation of the whole triangle, as seen in such genera as *Gomphæschna* (Plate XXXVII, fig. 1), *Brachytron* (Plate XXXVIII, fig. 2), and *Nisusæschna* (Plate XXXIX, fig. 1). Thus this cross vein has come to lie in such position that it appears in the adult wing to be a continuation of the cubital trunk, and it has generally been so interpreted.*

* *Pentathemis membranulata* Karsch (Ent. Nachr., XVI, 1890, pp. 33-35) presents a somewhat unusual condition of this cross vein, in that it is declined to the maximum and bent upward in the middle at its junction with a cross vein in the supertriangle which has migrated outward upon it half the length of the triangle. This condition, very like that seen in the hind wing of *Tetrathemis* (fig. 10), only a little in advance of that, has resulted in the triangle, after once attaining triangular form, becoming again four sided. Clearly, it is not five sided as Karsch thought. His alternative explanation (same reference, p. 35), rejected because the triangle would not reach vein M_1 , and the supertriangle would be in contact with the discoidal areolet—a condition seen in the hind wing of *Necordulia* and *Hemicordulia* (Plate XLII, figs. 1 and 2) and in many Libellulines—is the right explanation, and the name *Pentathemis* is the result of a misinterpretation.

3. *The ascent of vein Cu_1 .*—The cubital fork is in all Odonata at the hind angle of the triangle. When the distal end of the anal vein meets the cubitus squarely at this point, a struggle ensues between the branches of the cubitus for the maintenance of this strong point of support. In a series of genera Cu_2 wins, and Cu_1 is starved and crowded out, becomes much the weaker vein, and is forced to ascend the outer side of the triangle. This has happened in both fore and hind wings of *Pseudophlebia minima* (Plate XLV, fig. 1). The successive positions it assumes are epitomized in the diagram; they may be verified in the hind wings of such genera as *Agrionoptera* (Plate XLIV, fig. 1), *Mesothemis* (Plate XLV, fig. 3), *Diplacodes* (Plate XLV, fig. 2), and *Microdiplax* (fig. 13).

4. *The descent of vein Cu_2 .*—A happier solution of the struggle just mentioned is found when vein Cu_1 is left in possession of the hind angle of the triangle, vein Cu_2 descending at a right angle from the fork, carrying the tip of vein A_1 with it for its own support. We have already seen that a very perfect adjustment of this sort exists throughout the Calopterygidae, where vein Cu_2 appears as the direct continuation of vein A_1 . Our diagram illustrates the manner in which this adjustment is brought about in the Libellulidae. This will be better understood by examining the fore wings of such genera as *Agrionoptera* (Plate XLIV, fig. 1), *Anatya* (Plate XLIV, fig. 2), *Ruphisminia* (Plate XLIV, fig. 3), and *Ephidutia* (Plate XLVII, fig. 2).

Differentiation between fore and hind wings at the triangle.—Primitively, fore and hind wings of Odonata were alike, and the arculus was a little beyond the triangle in both, with the anal vein extending to the hind angle of the triangle (conditions still preserved in *Cordulegaster* (fig. 25)). The above diagram of these parts (fig. 14) will therefore stand for either wing.

In the space between the cubital and anal veins before the triangle are two crossveins which may fairly be considered typical, and which, because of the frequent necessity for reference to them, we will designate as the first and second cubito-anal crossveins (a and b of all the figures). The part of the cubital space beyond the first cubito-anal crossvein will be seen to lie directly beneath the quadrangle (which it much resembles). It may be conveniently designated as the "subquadrangle" (sq), and the part of this beyond the second cubito-anal crossvein as the subtriangle (t' of all the figures; called also, elsewhere, "subtriangular space" and "internal triangle").

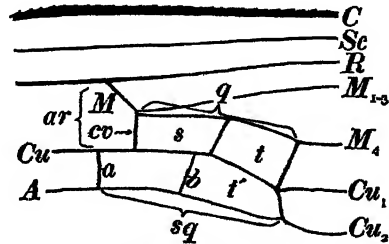


FIG. 14.—DIAGRAM SHOWING BASE OF TYPICAL DRAGON-FLY WING; SHOWING AT a AND b FIRST AND SECOND CUBITO-ANAL CROSSVEINS; SHOWING ALSO QUADRANGLE (q), SUBQUADRANGLE (sq), SUPER-TRIANGLE (s), TRIANGLE (t), AND SUBTRIANGLE (t').

Differentiation between fore and hind wings has been most completely carried out in the Libellulidæ,^a and, fortunately, almost all the steps are still to be seen in living genera. In this family two very different processes have operated in the two wings:

A. The procession of the triangle in the fore wing.—In all but the more generalized Libellulidæ the anal vein seems to run directly to the antero-internal angle of the triangle, while retaining in the hind wing its usual course to the hind angle. This is a puzzle; but the key to the puzzle is found in the behavior of the second cubito-anal crossvein and the anal vein. The accompanying diagram (fig. 15) epitomizes what has taken place.

The anal vein formerly went directly to the hind angle of the triangle in the fore wing. Then, through the simultaneous deflection of crossvein and anal vein, the latter came to appear forked—a stage

it has reached and still maintains in most Gomphinæ. Then the basal part of the anal trunk was carried forward into direct line with the still further deflected second cubito-anal crossveins, so that the latter appears as the continuation of the vein, and not at all as a crossvein, while the distal end of the anal vein is almost lost among the crossveins on the proximal side of the triangle. Thus it is that the anal vein seems to join the front angle of the triangle.

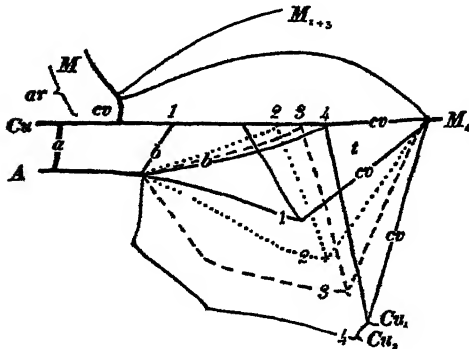


FIG. 15.—DIAGRAM ILLUSTRATING THE PROCESSION OF THE TRIANGLE AND THE DEFLECTION OF THE ANAL VEIN AND SECOND CUBITO-ANAL CROSSVEIN IN THE FORE WINGS OF LIBELLULIDÆ. *a*, THE FIRST, AND *b*, THE SECOND CUBITO-ANAL CROSSVEINS; 1, 2, 3, AND 4, SUCCESSIVE POSITIONS.

With the acquisition of new responsibilities, the second cubito-anal crossvein has waxed stronger and longer, and has pushed the inner angle of the triangle toward the outer, making the triangle narrow, and bringing about by this means its apparent remoteness from the arculus. Such genera are illustrated in Plates XLIII, XLV, and XLIX, and show the steps in this process. Simultaneously the

^aTheir differentiation in function was proved experimentally by Girard (1862. Note sur divers experiences relatives a la fonction des ailes chez les insectes, Ann. Soc. Ent. France, (4), II, pp. 153-162). His results that are of most interest here were gotten by simply clipping off one pair of wings at a time. Thus he showed that in *Agrius*, with fore and hind wings practically alike, flight is fairly well sustained with either pair of wings alone: *Libellula* can fly with the fore wings only, but with the fore wings removed the hind wings alone will not sustain it in the air. I have verified these results, using *Enallagma* and *Sympetrum*. I have also made some new experiments to determine the utility of certain structures. Brief reference will be made to my results farther on.

deflected portion of the cubitus (the inner side of the triangle) has been elongated, producing the very narrowly elongate triangle of *Libellula* (Plate XLVIII, fig. 3) and its allies.

B. The recession of the triangle in the hind wing.—The behavior of the triangle in the hind wing has consisted simply in its retraction through the successive position shown diagrammatically in fig. 16, and illustrated in such genera as *Agrionoptern* (Plate XLIV, fig. 1), *Raphismia* (Plate XLIV, fig. 3), *Uracis*, (Plate L, fig. 2), and *Pantala* (Plate L, fig. 3). Doubtless this recession of the triangle of the hind wing could only be advantageous in connection with the developments described under the next heading and discussed again farther on.

The anal area.—In the Odonata there is no anal furrow or suture, as in most other insects, sharply delimiting an anal field. The anal vein, except in a few fossil forms (*Isophlebia*, fig. 31, etc.), is solidly joined to the cubitus, as already shown. We now pass to notice the distribution of the anal branches in the small area back of the cubital deflection.

Probably in the early Odonata the anal tracheal trunk occupied the position of the anal vein, well back of the cubitus. Ontogeny (see figs. 1 and 2) and analogy with insects

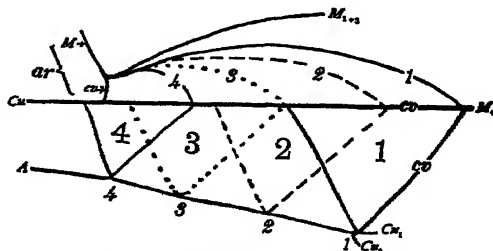


FIG. 16.—DIAGRAM REPRESENTING THE RECESSION OF THE TRIANGLE IN THE HIND WINGS OF THE LIBELLULIDÆ, 1, 2, 3, AND 4, SUCCESSIVE STAGES.

of other orders would both support this view. But in such recent forms as I have had for study this anal trachea is closely approximated to the cubitus beyond the base, and, midway to the triangle, descends to the level of the anal vein, and sends branches both proximally and distally, about which that vein is formed (fig. 2, and Plate XXXI, figs. 1-3). Even in the thick wings of nymphs of Anisoptera the contorted position and decreasing size of the anal trachea indicate that, like the costal trachea of the opposite wing margin, it is suffering from lack of room; or, perhaps, outstripped by the intervening tracheæ that are better situated in relation to air supply. At least we find, especially in thin and narrow wing cases, the anal trachea dwindles, and loses successively all its branches, which then become incorporated into the cubital air system. The best developed anal trachea we have seen is that of *Anax* (Plate XXXI, fig. 3), in which it will be noticed that the terminal branch, A_1 , is continued beyond its position of fusion with the cubitus in a recurrent position. In the hind wing of *Gomphus* (Plate XXXI, fig. 1) it will be observed that this recurrent portion is attached to vein Cu_2 ; A_1 , apparently, wanting; A_2 , strongly developed. In the fore wing of the same nymph A_2 has also been transferred to the cubitus, being

attached to the cubital trunk at the place where the anal vein bends strongly away from it. In all the Zygoptera I have been able to examine, all the branches of the anal vein have been transferred to the cubitus in both wings, the anal trunk being very greatly reduced or wanting (see Plate XXXI, fig. 2).

Such transference of the branches of the anal trachea lends the strongest support to the assumption already made regarding the transference of the trachea R_s to the media, in which case possible reasons for shifting and reattachment were much more clear.

The anal loop.—Owing to such shiftings of trachea, owing also to the expansion of this region in some wings, occasioning the development of accessory tracheal branches and its reduction in others, causing all the branches to disappear, the homologies of those branches which are oftenest present are followed with difficulty. Two of them, however (designated as A_1 and A_2 in the figures), must be considered here, since they together form an inclosure, which becomes one of the strongest

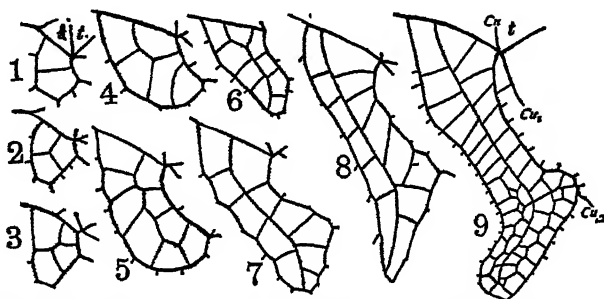


FIG. 17.—FORMS OF THE ANAL LOOP IN THE ANISOPTERA: 1, ANAL LOOP OF CYCLOPHYLLA DIPHYLLA; 2, OF Gomphodes stigmatius; 3, OF Gomphodes furcata; 4, OF Gomphomarcia parvula; 5, OF Syncordulia gracilis; 6, OF Agrionopterus insignis; 7, OF (?) Nanophya maculosa; 8, OF Ephidratia longipes; 9, OF Hydropsyche extranea.

of the supporting structures of the expanded anal area of the hind wings of the Anisoptera. This inclosure may fitly be designated as the *anal loop* (*al.* of all the figures). Fig. 17 will serve to show some of its more common and characteristic forms.

In some Aeschnine genera we find a supplemental loop (*al'*) developed between veins A_1 and Cu_{2a} . Fig. 3 of Plate XXXI shows how this is brought about; it is another accompaniment of the widening of the base of the wing. Since in the Libellulidae the anal loop extends from vein A_1 to vein Cu_{2a} , it is to be considered as the equivalent of both loops in *Anax*. Of the characteristic foot-shaped loop of the commonest Libellulidae the "toe" is of later development, and results from the concurrent elongation of veins A_1 and Cu_{2a} with the expansion of the hind angle of the wing.

After considering these changes severally, if we again compare fore and hind wing in any of the more specialized Libellulidae we shall see

that only the part of the wing which lies back of the median vein has been affected by them. But that part has been modified profoundly; in it entirely different ends have been wrought out in the two wings, and by different means. The fore wing is characterized by greater modification of parts present in the primitive wing; the hind wing, by the greater development of new parts.

III. SOME GENERAL FEATURES OF THE WING.

VEIN SHIFTING AND VEIN DIFFERENTIATION.

There are two kinds of specialization occurring simultaneously in insect wings, not clearly delimited, but, nevertheless, distinct enough to enable us to understand in a measure the reasons for the success of both. First, there is the shifting of veins for the mechanical advantage of position and the development of strong cross veins to aid in maintaining favorable positions. These developments have occupied our discussion hitherto. We have seen that the course of specialization is traceable in each part, and we shall see further on that the parts, varying independently or being modified together, collectively furnish most excellent characters for interpreting the genealogy of the group.

Second, there is a specialization which is not confined to any particular part of the wing or to any particular structure, but which consists in the progressive differentiation between veins and membrane, in the concentration of strength-giving wing material within the supporting veins, and in the reduction of cross veins. Although less tangible, perhaps, and certainly less useful for tracing genealogies, this kind of specialization is none the less real. The first furnishes characters differing in kind; the second, only those differing in degree. The first, rather than the second, is characteristic of fossil species, some fossil forms having carried the shifting of veins already described to extremes unparalled at the present time. The second, rather than the first, is characteristic of those modern genera which belong to the cooler regions of the globe. The first is often accompanied by very abundant^a venation. The second is indicative of keener competition in recent times and in temperate climates, necessitating greater economy of wing-building substance.

A comparison of the wings of *Neurothemis* (fig. 18) and *Tetragoneuria* (fig. 19), two genera of Libellulidæ that may fairly be taken as exponents of the two kinds of specialization, will make the difference between them clear. In *Neurothemis* we have venation "run wild"—the vein-building material scattered with great prodigality throughout the membrane, forming a very irregular and inconstant mesh work,

^aOne might almost say luxuriant. Possibly the advantage of the new position attained by the shifting of parts is so great that over development results from it at first.

such as was common to many early fossils of other orders and such as is still characteristic of the tegmina of the Locustidæ. In *Tetragoneuria*

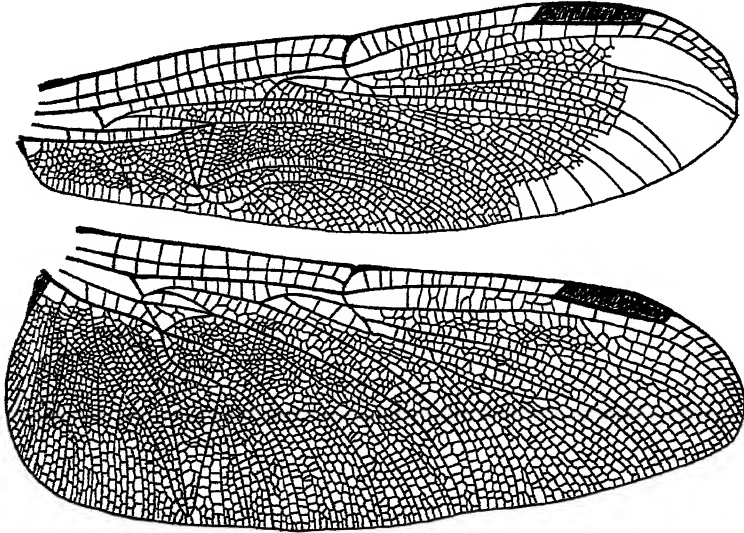


FIG. 18.—WINGS OF *Neurothemis oculata* FABRICIUS.

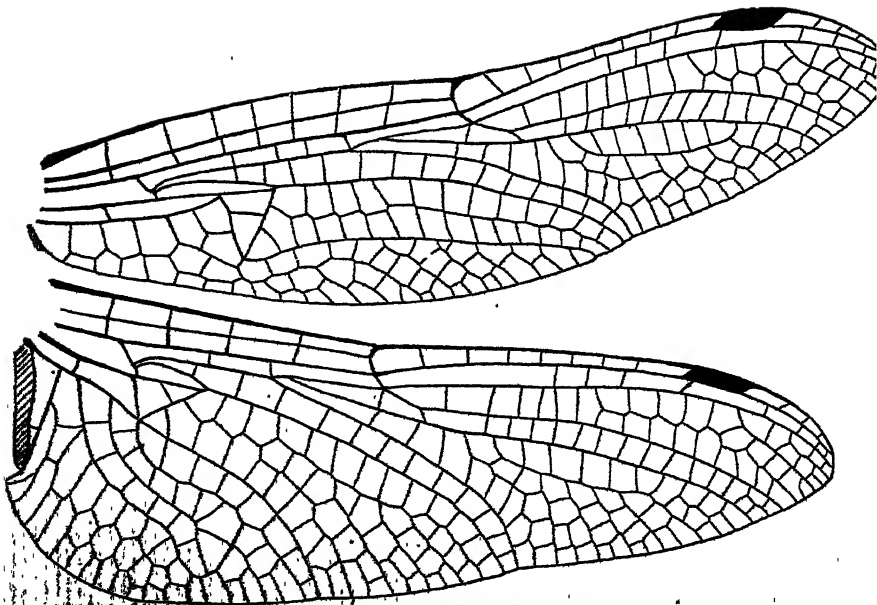


FIG. 19.—WINGS OF *Tetragoneuria cynosura* SAY.

order is brought out of this seeming confusion in the wing membrane. The veins are strong, the membrane is thin and more transparent,

cross veins are reduced so as to leave those that remain in such position that each seems to bear its individual share in the stress upon the wing. Instead of a dozen, more or less, of inconstant cross veins in the space between veins R_1 and M_1 , between nodus and stigma, as in *Neurothemis*, there are but three, and these three are constant, and so for other parts. In and about the triangle of *Neurothemis* are many veinlets which have been sacrificed to make the triangle itself stronger in *Tetragoneuria*. An actual count of the cells in a hind wing of *Neurothemis* gives the number 2,695; in a hind wing of *Tetragoneuria*, 265, the latter wing being at the same time a little larger. *Neurothemis* has far outrun *Tetragoneuria* in all those adjustments of parts in the region of the arculus, already described, as characteristic of the specialization of the Libellulidæ; but *Tetragoneuria*, having attained a fair measure of mechanically advantageous arrangement of parts, has attained success by disposing of its strength-giving wing material where it is most effective. *Tetragoneuria* is vastly superior in flight^a—is, indeed, one of the fleetest and most agile of winged creatures.

CROSS VEINS.

The vein-building substance of which we speak is of course hypodermis. The insect wing is essentially but a flat evagination of the body wall, with a few trachea grown out into it. During early development the hypodermis of the wing does not differ in any essential respect from that of other parts of the body. As elsewhere, it consists of a single layer of cells which secrete a protecting external layer of chitine. At the time of transformation, when the hypodermis of the two walls of the wing sac is bound together by fused internal processes, blood is forced out into the wing, greatly extending it laterally. The hypodermis is thus spread out in a very thin layer. As soon as a definitive layer of chitine is deposited, the hypodermal cells (which, of all cells known to me, possess the greatest capacity for speedy and extensive shifting and readjustment) begin to be segregated into groups along the lines of the veins that are to be, and there deposit additional chitine, which differentiates veins from membrane.

Doubtless in the earliest insect wings the segregation of the hypodermal cells was such as to give a membrane crowded with somewhat circular areoles, such as we find in the expanded lateral margins of the pronotum of the Tingitidæ, in the tegmina of the Locustidæ, in almost the entire wing of the fossil dragon fly *Æschnidium*, and in the wider spaces of the wing of *Neurothemis*. The principal veins first would become strongly marked by the accumulation of the hypodermal cells about the tracheæ. Cross veins would emerge from the meshwork, as they seem to be emerging in the wing of *Neurothemis*, in the spaces between veins R_1 and M_1 , between M_1 and M_2 , etc., by the dropping

^a I venture this unqualified statement without having seen *Neurothemis* fly.

out of reinlets that are longitudinally placed; or, as illustrated in the following diagram (fig. 20).

A few strong cross veins for binding the longitudinal veins together would be developed first. In the wider spaces between the longitudinal veins the cells would take on hexagonal form as soon as necessity for economy in the disposition of vein-forming substance arose, and hexagons would, of necessity, fall into regular series or rows. This condition would early be attained—has been attained or surpassed by almost all living Odonata. Meanwhile the reduction among cross veins goes on apace, and the fundamental thing in this reduction consists in the better marshaling of the hypodermal cells at the proper moment of transformation.

This brings us to the practical point, that cross veins are constant in number and position only when they have attained individual responsibility—when each has its own share in the stress of the wing stroke. Utility determines survival among cross veins as among species. No better illustration could be found than the two cubito-anal cross veins before the triangle in the wings of the Libellulidæ. The first of these is formed, as we have seen, about the descending portion of the anal

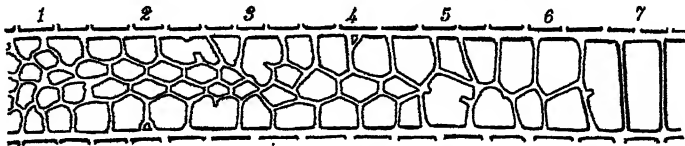


FIG. 20.—DIAGRAM ILLUSTRATING THE EMERGENCE OF STRONG CROSS VEINS.

trachea, and that is a sufficient reason why in the reduction of cross veins it never disappears. The second in the fore wing becomes braced against the front angle of the triangle and acquires new responsibility, which insures its preservation; one would as soon expect to miss those other cross veins which bound the triangle. But in the hind wing this same cross vein acquires no such importance—rather loses through the recession of the triangle any importance it may have had to begin with, so it early disappears. In the more generalized Libellulidæ it is always present; in the more specialized it is uniformly absent, but in a few, in this respect, transitional genera, it is present or absent indifferently. Similarly in the more specialized Libellulidæ but one cross vein persists in the space which the bridge incloses, and there is a very good reason why that one never disappears—it is formed about the descending trachea which precedes the bridge.

Very similar are the antenodal and postnodal cross veins, of which so much use has been made in systematic work. In the fore wing of Libellulidæ the antenodals are more than forty, the number being constant in *Libellula* they are always six. In the hind wing of Libellulidæ the antenodals are about twenty-five; in that of *Tetra-*

goneurii they are four. Those antenodals which early chance become "matched" across both costal and subcostal spaces brace the deepening subcostal furrow better and are more sure to be preserved.

Then there is a reduction of cross veins which seems not solely directed toward strengthening those that remain, but rather toward clearing out of spaces between the points of transverse union of longitudinal veins.^a This clearance takes place in different places in Libellulidæ and in Gomphinæ, correlated with the difference in shape and position of the triangle in the two groups. In the former the cross veins disappear (see *Pachydiplax*, Plate XLVII, fig. 1) from the spaces adjacent to the subnodus and the oblique vein and under the stigma. In the latter (see *Gomphus dilatatus*, Plate XXXIII, fig. 1) from the spaces just beyond the arculus. In the *Æschinæ*, with triangles similarly disposed, while the cross veins do not actually disappear just beyond the arculus, we find sometimes (as in *Anax*, Plate XL, fig. 3)

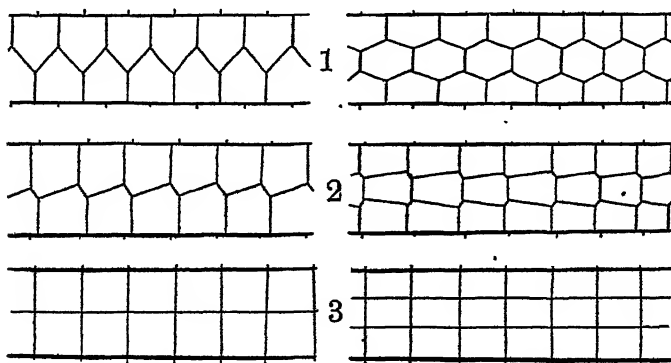


FIG. 21.—DIAGRAM SHOWING HOW HEXAGONAL CELLS BECOME RECTANGLES AND HOW CROSSVEINS BECOME MATCHED IN TRANSVERSE LINES ACROSS THE WING.

all the veins on the anterior side of the base of vein M_1 , between at and the radius, so dwindled that little more than thin membrane remains. This is much more evident in the actual wing than in the figure.

We have already referred to the matching of nodal crossveins. In the Agrioninæ this process is carried so far that all the crossveins of the body of the wing become arranged in transverse lines. A comparison of the wings of *Archilestes* (Plate LI, fig. 6), *Lestes* (Plate LIII, fig. 1), *Argia* (Plate LIII, fig. 5), and *Nehalennia* (Plate LIV, fig. 8) will illustrate the progress of this tendency.

^aAllowing, perhaps, for readier flexion of the portion of the wing posterior to the cleared spaces, though of this I am not sure. In Myrmeleonidæ (Plate XXXVI fig. 2) subcosta and radius are strongly bound together at base and at stigma, while the long narrow space between is free from cross veins. It would seem, since the wing is easily flexed behind this space, the costal margin remaining rigid, that an imaginary axis of flexion joins the two strong yet elastic terminal points of union.

The accompanying diagram (fig. 21) shows the steps by which crossveins may be brought into line. All these steps may be seen in the wings of Agrioninae represented in the plates and better still in fig. 9.

In Calopterygidae crossveins are so numerous it seems to have been of more moment (at least in Calopteryx and its nearest allies) that the longitudinal lines of crossveins should become straight, allowing the longitudinal furrowing of the base of the wing to be extended to the margin.

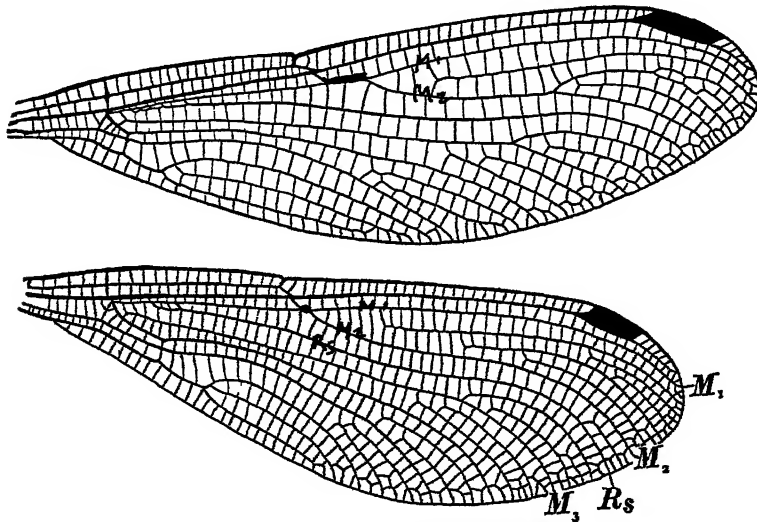
SECTORS AND SUPPLEMENTS.

The areolæ, or cells, of the wing membrane are potential hexagons. Where bordered on one side by a straight vein they are converted into pentagons by the elimination of one angle; where included in a single row between two veins they become quadrilaterals, through the elimination of two angles. Even in the broader areas of the wing their hexagonal regularity is early disturbed by two more or less distinct means: (1) by the development of new tracheal branches, which penetrate into the broader spaces, straightening out certain broken lines of crossveins and converting their bordering hexagons into pentagons; (2) by the development of longitudinal veins, independently of the tracheæ—veins which traverse the same spaces in a direction generally more or less transverse to that of the accessory tracheæ and complete the havoc of the hexagons. By the first means are produced extra branches of principal veins, which so appear in the adult wing. Some of the most important of these are designated M_{1a} , Rs_a , Cu_{2a} , etc., in the figures. By the second means are developed curved veins, which are generally opposed in position to the principal veins bounding the wider spaces anteriorly. These may be called *supplements*. Both are well shown, and the difference between them is clearly demonstrated by Plate XXXII, fig. 1 of *Anax junius*. The principal trachea shown is the radial sector, whose branches are accessory; the strong, developing vein that sets across them, bending toward the radial sector at both its ends, is the *radial supplement* (*R. suppl.*, of all the figures). It will be seen to be a purely cuticular vein, without trachea of its own. Behind vein M_1 is an exactly similar vein, the median supplement (*M. suppl.*, of all the figures). Behind vein M_1 and proximal to vein M_{1a} , though often joined to the latter, is another, the apical supplement (*ap. suppl.*), well shown in *Tramea* (Plate XLIX, fig. 3) and its allies. From the outer side of the triangle there starts another, the trigonal supplement (*trig. suppl.*) well shown in *Hagenius* (fig. 23), and in most *Æschinæ* (Plates XXXVII–XL).

Both supplements and extra branches, being relatively recent acquisitions are well developed only in the more specialized members of the several groups.

UNEQUALLY DEVELOPED WINGS IN THE SAME SPECIES.

1. *The specialization of fore and hind wings to an unequal degree, when both (or the parts concerned of both) are following similar lines.*—A single illustration of this will suffice. In *Chalcopteryx* (fig. 22) the fore wing has in several points outrun the hind. For instance, vein M_2 separates from vein M_1 in the hind wing at the subnodus, as is usual; but in the fore wing M_2 has fused with M_1 for the space of several cells' length beyond the subnodus. Again, in the space between veins M_1 and M_2 there are a number of interpolated sectors, all of which are independent of the veins in the hind wing, but in the fore wing the next to the longest of these has become attached to vein M_2 in such position that M_2 now appears forked. It will be seen at a

FIG. 22.—WINGS OF *Chalcopteryx rutilans* RAMBUR.

glance that the anterior branch of this fork is the same thing as the independent sector occupying the same position and relations in the hind wing. First, a broken line of crossveins became straightened out longitudinally to form the sector; then, one of the crossveins lying below its proximal end in the fore wing became declined to brace the sector against vein M_2 . But the bracing of the wing tip did not stop with this. The upper branch of the fork has acquired a lesser fork of its own, whose anterior branch is in like manner developed out of a still shorter sector, which has remained independent in the hind wing. Again, the longer of the two sectors in the space between veins R_3 and M_3 in both wings become attached to vein M_2 ; a symmetrical fork has thus been developed in the fore wing, but in the hind wing the adjustment is still imperfect.

2. *Unequally developed wings in the two sexes.*—The wings of the male often outrun those of the female. The best-known instance is the frequent angulation of the anal area of the hind wing in the male, the hind angle of the female always remaining rounded. In *Hagenius* (fig. 23) it will be seen that the difference in conformation of the anal angle has slightly affected the form of the anal loop also.

In that part of the Calopterygine series in which the stigma is lost it is retained longest in the females.

In *Agrion* (fig. 4, t.) it retains a much more primitive form in the female. The curious stigma of the fore wing of the male of *Anomalagrion* (fig. 4, u.) has outstripped that of the hind wing, but even the latter is somewhat less primitive than either stigma in the female.

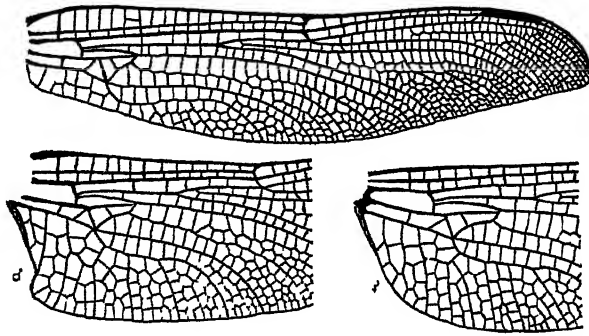


FIG. 23.—WINGS OF *Hagenius beccistylus* BEYR.

The reason for the greater specialization of the wings in the male is, of course, so well known as to need only passing mention. The males, and not the females, seek their mates and compete for them upon the wing, often amid great rivalry.

SUMMARY OF THE MORE GENERAL TENDENCIES OF VEIN EVOLUTION WITHIN THE ORDER.

The facts of ontogeny and comparative anatomy hitherto presented seem to warrant a number of conclusions as to the development of the several parts, which conclusions may be expressed in tabular form as follows:

Generalized condition.

Subcosta long; nodus remote from wing base.

Antenodal and postnodal cross veins numerous, weak, irregular (not matched), and none of them hypertrophied.

Stigma without special support.

Developmental tendencies.

Subcosta becoming shortened and the nodus retracted.

Antenodal and postnodal cross veins becoming reduced in number, stronger, more regular, sometimes matched in position or differentiated among themselves.

Stigma becoming supported, proximally by a brace vein (hypertrophied cross vein), and distally by a sector

Bridge weakly or incompletely developed; oblique vein remote from the subnodus.

All principal veins straight or gently curved and evenly forking.

Media at the top of the arculus.

Veins M_{1-3} and M_4 at their departure from the arculus, separate and straight.

Triangle, supertriangle, subtriangle, etc., ordinary quadrangular areoles (perhaps traversed by weak cross veins).

Cubitus somewhat symmetrically forked.

Anal angle of the wing unsupported.

Cross venation dense, irregular, and inconstant.

Fore and hind wings alike.

Bridge becoming strong and directly attached to vein M_{1+2} ; oblique vein, retracted toward the subnodus.

Some principal veins becoming strongly angulate at points of special bracing.

Media descending the arculus.

Veins M_{1-3} and M_4 becoming fused, or strongly arched upward, or both.

Triangle, etc., becoming strong and highly differentiated inclosures

Cubital fork becoming strongly unilateral.

Anal angle becoming supported by the junction of veins Cu_2 and A_1 and, sometimes, by the development of an anal loop.

Cross veins becoming fewer, stronger, more definite and regular, and the membrane, thinner.

Fore and hind wings differentiating (1) by following parallel paths with unequal speed, and (2) by following different paths.

IV. LINES OF SPECIALIZATION.

Hitherto we have been discussing wing characters more as individual entities than as mutually dependent parts of a single organ. The illustrations of the steps in the development of each, drawn from adult wings, have been selected arbitrarily, and have not always been drawn from a single line of development. They have served the purpose of illustrating in a general way the progressive modifications of each part, confirming the ontogenetic record. In their application to this end we have necessarily overlooked the lesser individual peculiarities of each. Correlated characters varying independently preserve, some here, some there, bits of the ancestral record, but with more or less of individual alteration of it. It is probable that every one of the characters discussed in this paper would be found on closer study to possess distinctive features in each genus—earmarks of the genus. This, of course, applies not to wing parts alone, but to every other part as well.

We come now to consider these same characters in their ensemble. Their individual records, of course, do not agree. Did they agree, we should have a single lineal series, very well adapted to book making. We should have a wing exhibiting the generalized characters just mentioned with which to begin the series. But while it has been easy to show by concurrent ontogeny and comparative morphology that

the characters there presented are relatively primitive for the group, and while each of these characters is exhibited in some of the more generalized forms, it is quite impossible to find a single wing embodying them all. Let us therefore now carefully compare the several records and discover, if we may, the history of the principal Odonate wing types.

THE FIRST DICHOTOMY.

The first dichotomy has been already indicated, or, at least, implied. Aside from the crossing of the radial sector, respecting which all dragon-fly wings are in essential agreement, the quadrangle has certainly played the most important rôle in the evolution of these wings. Upon the quadrangle two distinct tendencies have operated, (producing the suborders Zygoptera and Anisoptera.) In the former the tendency has been to preserve the quadrangle as a unit of wing structure, to continue vein *Ch*₄ outward from it in direct line, and to set off *Ch*₃ squarely upon the distal end of vein *A*₁. In the latter the tendency has been to divide the quadrangle into triangle and supertriangle, and to differentiate between fore and hind wing. Supplements are developed only in the latter, while the tendency toward the matching of cross veins and the reduction of the base of the wing are characteristic only of the former.

SUBORDER ANISOPTERA.

Again, in the two great families of this suborder two dominant tendencies are almost equally plain. In the *Æschnidæ* these are toward (1) the similar elongation of the triangle in both wings; (2) the development of strong supplements; (3) the hypertrophy of two antenodal cross veins; (4) the development of a brace to the stigma, and (5) the angulation of the hind angle of the hind wing in the males. In the *Libellulidæ* there is the single, more definite, and more exclusive tendency, already discussed, toward the differentiation between fore and hind wings at the triangle.

A. Æschnidæ.—The family *Æschnidæ* is a bundle of remnants. In it are found no less than eight fairly distinct types of venation. The types represented by *Heterophlebia*, *Stenophlebia*, and *Æschnidium*^a are extinct. That of *Petalura* was much more abundant in past times than now. *Chlorogomphus* and *Cordulegaster* are represented by but a few isolated species. Only the groups of *Gomphus* and *Æschna* are dominant at the present time. In some cases, therefore, there is no

^aAttention should be called here to the peculiar and altogether isolated type of venation found in *Æschnidium*. In wings, otherwise like those of the *Æschnidæ*, the shifting of the anal vein up toward the inner angle of the triangle is completely carried out in both fore and hind wings. In this, and also in the secondary developments for supporting the expanding anal angle, *Æschnidium* far outran all living forms. In the matter of differentiation between veins and membrane, however, and the reduction of cross veins, it remained very generalized indeed.

material to be had for tracing genealogies, and we will attempt to point out only the more important venational features, comparing them with the conditions we believe to be primitive for the order.

Chlorogomphus.—This (fig. 24) is an isolated living type, specialized in the extensive differentiation between fore and hind wing by the development of an expanded anal area upon the latter, generalized in its unbraced stigma and in its retention of cross veins in the space before the arculus. It parallels *Macromia moorei* in the peculiar form of its anal loop, and *Hemianax ephippiger* (Plate XXXVI, fig. 3) in the circuitous course of vein Cu_2 . It is unique among the Odonata known to me in that the triangle of the hind wing has been elongated transversely to the axis of the wing, while that of the fore wing is equilateral.

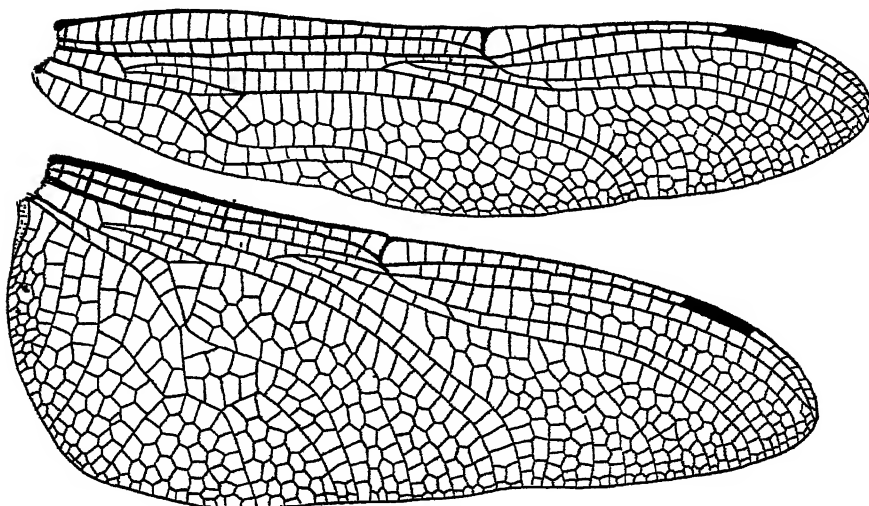


FIG 24.—WINGS OF *Chlorogomphus magnificus* SELYS, FEMALE.

The Cordulegaster group.—This small group has retained some decidedly primitive features. Anal vein and second cubito-anal cross vein have retained their primitive position and relations in both wings. The triangles are alike, and only moderately elongated. No supplements are developed; and there is no brace to the stigma, or only a very imperfect one in *Petalia* and its allies. There is, however, a moderate enlargement of the base of the hind wing, and this becomes angulate in the males. *Cordulegaster suyi* (fig. 25) and *Phyllopetalia apicalis* (fig. 26) represent the divergence of the group; there is uniformity in the more important wing characters. There has been a slight development of accessory branches upon the radial sector, and in the wing of *Phyllopetalia* will be noticed the undulate course taken on by veins M_2 and R_s , and by M_2 and M_4 ; but the reduction of redun-

dant cross veins, and the strengthening of the principal veins and braces seem to have been the means whereby these wings have attained their goodly measure of efficiency.

Æschniæ.—We come now to a group that is flourishing in our own time the world over. It contains the largest of our common dragon-

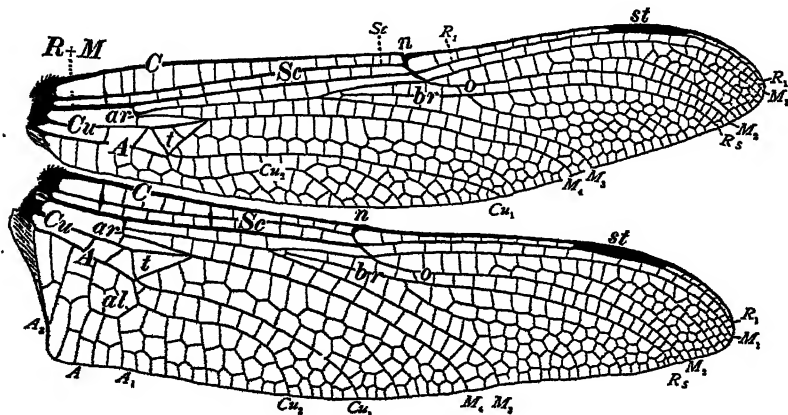


FIG. 25.—WINGS OF *Cordulegaster sayi* SELYS.

flies, all strong-flying species, composing many genera. In the more specialized genera are many species. There is great variety in the details of the luxuriant venation of the group. Here, then, we have opportunity to apply the facts of development previously outlined to the unravelling of a bit of genealogic history.

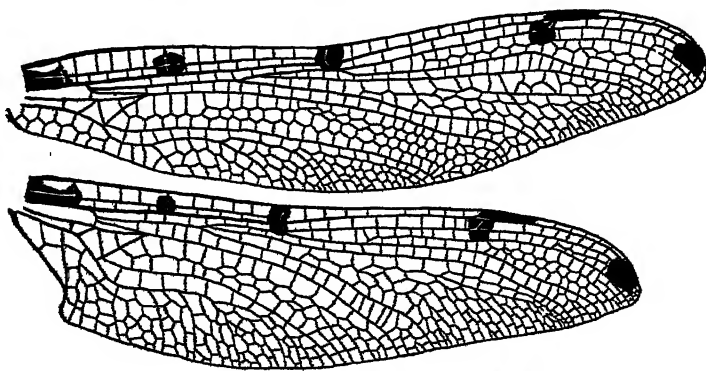


FIG. 26.—WINGS OF *Phyllopetalia apicalis* SELYS.

The most characteristic features of the *Æschnine* wing are (1) the approximation of veins M_1 and M_2 , brought about by the bending forward of vein M_2 at the stigma, (2) the development of strong and broadly curved supplements, and (3) the elongation of the triangles in the direction of the axis of the wing. These will be seen in their best development in such genera as *Æschna* and *Anax* (Plate XL.)

Doubtless, the most generalized group within the Aeschnine series is composed of *Cymatophlebia* (fossil), and *Gomphæschna* (Plate XXXVII, fig. 1), which have the triangle little elongated, all supplements but little developed, the anal loop small and compact, with no supplemental loop, and the anal angle of the hind wing, therefore, not greatly dilated, but which always have the stigma braced against vein M_1 opposite a forward bend in vein M_2 . These all exhibit affinities with the preceding and the next following groups. Even the upward bend of vein M_2 at the stigma is hardly more marked in *Gomphæschna* than in *Phyllopetalia* (fig. 26).

Passing by these two genera, we next come upon a number of others which have a more pronounced Aeschnine aspect, as *Boyeria* (Plate XXXVII, fig. 3), *Basiaeschna* (Plate XXXVII, fig. 2), and *Hoplonaeschna* (Plate XXXVIII, fig. 1). These have vein M_2 more strongly bent toward the stigma, the triangles longer, radial and median supplements well developed, and trigonal supplement and supplementary anal loop developing. In these genera the radial sector is not forked.

In *Aeschna* and its nearest allies (Plate XL) we see the further progress of these tendencies. There is this added feature—the radial sector has become forked. It will be observed that the anterior branch of this fork is separated from vein M_2 by a single row of cells, and that in the same place in *Basiaeschna* (Plate XXXVII, fig. 2) there is a line of cross veins tending to straighten out. The anterior branch of the fork is developed out of this line of cross veins. In the Australian *Aeschna brevistyla* (not figured herein) all stages of its completeness and incompleteness may be found in a series of specimens. In the nymphal wing of *Anax junius*, a strong trachea is seen to precede only the posterior branch of the fork. Thus the anterior branch of the fork is clearly a relatively recent acquisition of such genera as *Aeschna*, *Gynacantha* and *Anax*, the dominant genera of the subfamily.

In tracing this relatively simple developmental line that leads to the highest specialization of this kind to be found, we have purposely passed by several lateral offshoots. The one of these which seems nearest allied to *Aeschna* is represented by *Neuraeschna* and *Staurophlebia* (Plate XXXIX, fig. 2), which, having retained the tip of the subcosta which extended beyond the nodus and many cross veins in important spaces, are not to be derived directly from forms in which these have been lost; lacking a brace to the stigma, can not have sprung directly from such genera as those of the Boyeria group in which this useful structure is well developed, but may well have sprung from the common ancestor of *Boyeria* and *Aeschna*.

Furthermore, *Anax* (Plate XL, fig. 3), while very highly specialized, has retained the most primitive position of the media at the arculus to be found in the group, and has the hind angle of the hind wing rounded,

and not angulated, in the male. These characters, together with others found in other organs, give cause for setting apart *Anax* (with *Hemianax*, Plate XXXVI, fig. 3) as constituting a different developmental line from the one in which *Æschna* is found.

Then there is the important Brachytron group of genera (*Brachytron* (Plate XXXVIII, fig. 2), *Æschnophlebia* (Plate XXXVIII, fig. 3), *Planæschna*, *Calizæschna*, *Nasizæschna* (Plate XXXIX, fig. 1), *Epizæschna*, etc.), which seems at first sight so closely allied to *Æschna*, which was set apart by Karsch^a for systematic purposes, on excellent venational characters, the manner and the purport of whose development remain to be indicated. The radial sector is forked in these, but after the anterior branch is acquired the whole sector does not, as in *Æschna*, bend anteriorly, arching away from the radial supplement, which becomes bent in the opposite direction, but both remain straight, and the tendency seems to be toward strengthening and deepening the fork. As a consequence, vein M_{1a} is allowed in the Brachytron group to occupy its accustomed place and to bear its share in the stress of the wing stroke, not being crowded out, as in the *Æschna* group, by the encroaching distal end of vein M_2 .

Boyeria seems to stand near where was the parting of the ways that led to the development of these two groups. One may see that either form of radial sector might readily have been derived from that of *Boyeria* (Plate XXXVII, fig. 3).

The study of the trigonal supplement adds force to such opinion. In *Boyeria* it might be interpreted as joining the median supplement, or as passing below it with a single row of cells between; its position is not decided. But in the *Æschna* group it distinctly joins the median supplement, and in the Brachytron group it distinctly extends below by one row of cells.

The behavior of the distal ends of veins M_3 and M_4 offers still further corroborative testimony. Beginning with a condition like that found in *Boyeria*, where there are several rows of cells included between these two veins for the distal third or fourth of their length, the veins themselves being parallel, development takes place along two distinct lines. In the Brachytron line these veins remain parallel, and specialization consists in the progressive reduction of the cells between them to a single row. In the *Æschna* line, vein M_4 becomes bent away from vein M_3 at a point opposite the proximal end of the radial supplement, while reduction proceeds as usual on either side this place. (See *Æ. californica*, Plate XL, fig. 1, and *Æ. ingens*, Plate XL, fig. 2.) It will be observed that the vein M_4 finally appears to run into vein M_3 . This is wholly due to the increasing deflection of vein M_4 and to the straightening out of two cross veins which happen to lie opposite the point of deflection. These cross veins first are so

^a *Beiträge zur Kenntnis der Aeschniden*, Ent. Nachr., XVII, pp. 273-290.

placed as to cause vein M_4 to appear forked (see *Æ. californica*, Plate XL, fig. 1), when they appear as the upper branch of that fork; finally they appear as the true continuation of the vein. As the anal vein is switched upon the second cubito-anal cross vein in the Libelulidæ, so here vein M_4 is switched into an entirely new position upon two cross veins.

It is worthy of passing remark that this shifting is an accompaniment of differentiation between longitudinal veins in very highly specialized *Æschninæ*. This will be much more clearly seen in actual wings than in the best of figures. A glance at such wings as those of *Anax junius* or *Æschna californica* will discover that R_s is strong, M_2 is weak; M_4 is strong, M_3 is weak; Cu_2 is strong, Cu_1 is weak. The strong vein bounds posteriorly the space in which the weaker one lies. The cross veins just discussed, which join vein M_4 so solidly to vein M_3 , together with several lines of cross veins descending from the strongest part of the radial sector, complete the boundary of the space in which the weakest part of vein M_3 is included.

But to return to our theme, we have seen that the behavior of radial sector and supplement, of trigonal supplement, and the distal ends of veins M_3 and M_4 furnish cumulative testimony to two divergent lines of development, which, starting with forms a little less *Æschna*-like than *Boyeria*, have evolved the groups of *Brachytron* and *Æschna*. And we have shown that, with respect to venation at least, the groups of *Neuræschna*, *Anax*, and *Gomphæschna* are successively more remote.

Gomphinæ.—In this group we come upon another type of *Æschnid* venation, a type which is chiefly characterized by the similar shifting of the anal vein in both wings, but only to such extent that that vein appears more or less symmetrically forked. There are few venational specialties. Neither the shifting of veins for advantage of position nor the reduction of cross veins have proceeded very far. That venation is at a standstill is indicated by the unusual constancy of mechanically unimportant cross veins, such, for instance, as the one traversing the supertriangle. Variation from the type is slight, considering the large number of genera in the group; and such as there is, it does not lend itself readily to serial arrangement. The very moderately widened anal angle of the hind wing is supported mainly by straight and parallel anal and cubital branches, as in the more generalized *Æschninæ*. An anal loop is developed in many genera, but has so different aspect in several of them it seems quite possible it may have been developed several times independently. (See *Lanthus*, Plate XXXV, fig. 3; *Cyclophylla*, Plate XXXIV, fig. 1, and *Hagenius*, fig. 23.) A strong trigonal supplement is developed in *Hagenius*. The declined portion of the cubitus (inner side of the triangle) becomes elongated in the fore wing more than in the hind in *Cyclophylla* and *Aphylla* (Plate XXXIII, fig. 3). Accessory sectors of unusual strength

are developed upon the posterior side of veins R_s and M_1 in *Gomphidia* (Plate XXXIV, fig. 3). Possibly these features indicate the tips of numerous short developmental twigs. The brief records of the several parts are certainly contradictory; and the parts themselves, which one might use as bases for the first divisions of the group, seem so nearly of equivalent importance that one may hardly choose between them with assurance. Probably the records of other organs will be more easy of interpretation.

The South American genus *Agriogomphus* (fig. 27) exhibits venational characters that are quite as generalized as are to be found in the group. Triangle and subtriangle are still four-sided, the cubital and anal veins before them being but moderately angulated, the stigma is weakly braced, there is no anal loop and there are no supplements.

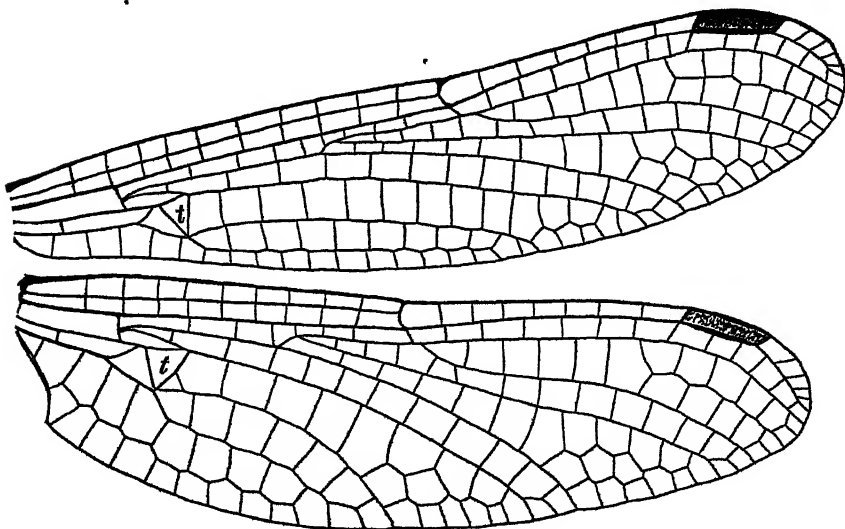


FIG. 27.—WINGS OF *Agriogomphus* sp?

We may remark, in passing, that the Gomphinae, having attained a fair measure of advantageous vein arrangement, and a fair (or, in the strongest species, even a superior) degree of vein differentiation, seem to have turned to a specialization of another sort. The imagoes are on the wing less constantly than other Odonata and fly for a shorter period. During this time their chief concern is with reproduction, hence we find the external genitalia highly specialized. The shortening of the period of imaginal life is correlated, also, with extreme specialization of the nymph. In fact, the struggle for existence has been mainly transferred to nymphal life.*

* I have discussed this matter more at length in my paper, Preliminary studies of North American Gomphinae, Can. Ent., XXIX, 164-168, 1897.

Petalurinae.—The type of venation presented by this singular group parallels, rather remotely, the Libellulidæ in the behavior of the anal vein, shifting as it does upon the second cubito-anal cross vein to brace the antero-internal angle of the triangle in the fore wing, retaining a more direct course to the hind angle in the hind wing. It parallels the fossil *Stenophlebia* in the curvature of the wing outlines, tending toward a somewhat sickle-shaped wing apex. The very peculiar, narrowly linear stigma is directly correlated with the wing form. It will be observed in the genera *Tropetula* (fig. 4, s) and *Phenes*, in which the costal space is most narrowed and the stigma most curved and elongated, the brace vein has migrated away from the stigma toward the nodus. In this group the anal loop is often not well differentiated (fig. 28). Excepting at the base of the wing, reduction of cross-veins has not been carried very far. *Tachopteryx hugeni* (fig. 29) seems to be the most generalized living member of the group (compare with Plate XXXVI, fig. 1). It will be observed this one is most like the Gomphinae, the subfamily which is doubtless nearest akin. The group is a very small one, apparently on the wane.

It is well represented among the Tertiary fossils of Europe. Of living species

there is one in the eastern United States, one in Nevada, one in Japan, and there are several each in Chile and the Australian region.

B. Libellulidæ.—This family, unlike the *Æschnidæ*, exhibits a single type of venation, whose dominant tendency is toward the differentiation between the wings, by means of the procession of the triangle, and the switching of the anal vein in the fore wing, and in the hind wing the recession of the triangle and the elongation of the anal loop. The stigma is never braced, and the bridge remains shorter than in the *Æschnidæ*, with fewer included cross veins.

Macromiinae.—Members of this group (Plate XLI, figs. 1 and 2) have followed these tendencies a little way, and have then gone off on

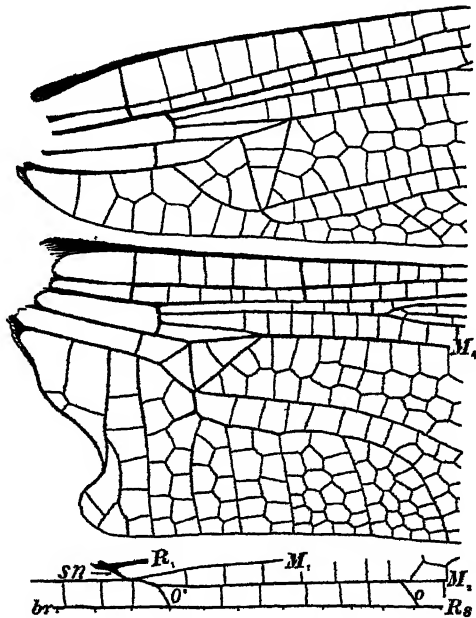


FIG. 28.—BASES OF WINGS OF *Petalura gigantea* LEACH, AND A DETAIL FROM THE REGION OF THE NODUS, SHOWING THE BRIDGE WITH TWO OBLIQUE VEINS, O' AND O.

lines of their own, specializing highly. The shifting of the anal vein in the fore wing, the fusion of the branches of the media beyond the arculus, the development of a strong anal loop (of almost *Cordulegasterine* form, to be sure), the retraction of the nodus in the hind wing, and especially the general reduction of cross veins and the narrowing of the apex of the wing, mark this as a peculiar group, more distinct than any other within the Libellulid series, and well worthy of sub-family rank.

Libellulinae, including *Cordulinae*, s. str.—Passing *Macromia*, and passing also a few isolated forms with triangles in the fore wing four sided and in the hind wing often little retracted and with the anal loop short, indistinct, or wanting^a—all lateral offshoots, I believe, from near the bottom of the Libellulid series—we come upon a series of closely related forms, the most extensive and flourishing in the order. It were idle to attempt to indicate all the lines of specialization to be

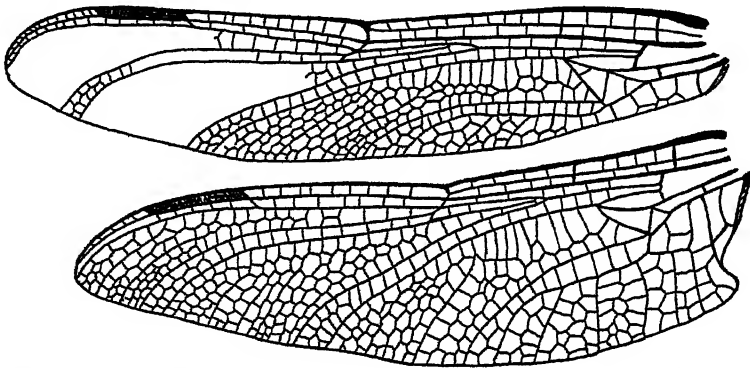


FIG. 29.—WINGS OF *Tachopteryx lagani* HELYER, DETAILS IN PART OMITTED IN FORE WING.

found in the wings of this series. We will endeavor to point out only a few of the leading tendencies that are superadded to the more general ones already noticed.

It is most interesting to note, in this series, how the two venation-evolving processes already discussed, vein adjustment and vein differentiation, have alternately held sway. Thus, in the first instance, vein adjustment has been carried out to a very moderate extent, vein differ-

^aI pass these by because I have not found the genetic thread that will bind them into a natural series. I have seen but few of them (*Tetrathemis*, fig. 10; *Nannodythemis*, *Nannothemis* (Plate XLIII, fig. 2), *Nannodiplax*, and *Nannophya*), and in this paper we are dealing only with lines of development. These are among the rarest of specimens in collections, and differ so much among themselves that there are of them almost as many genera as species. They have all the earmarks of developmental remnants. If Karsch's group *Nannophya* (Ent. Nachr., XV, pp. 245-263) should be made to include all these forms, it should include also *Cordulephya* and perhaps *Japyx*, which have more affinity with some of these than with any of the *Cordulinae* proper.

entiation to a remarkable extent, and the result has been the evolution of the Corduliinæ, *s. str.* (Plate XLII.) The branches of the media are never extensively fused at their departure from the arculus. The true course of the anal vein behind the triangle is never obscured. The anal loop never becomes distinctly foot shaped. It is short in *Gomphomacromia* (Plate XLIII, fig. 1); longer and shaped like the conventional diagram of a simple gland in *Orygastera* (Plate XLII, fig. 2), truncated on the end but not widened in *Neocordulia androgynis* (Plate XLII, fig. 1); squarely truncated and slightly widened in the undescribed *Neocordulia* shown in fig. 30; and obliquely truncate and increasingly widened on the "toe" side in *Hemicordulia* (Plate XLII, fig. 3), *Somatoclora*, etc. In short, the vein shifting of the Libellulidæ is far from reaching its maximum in this group, but a fairly

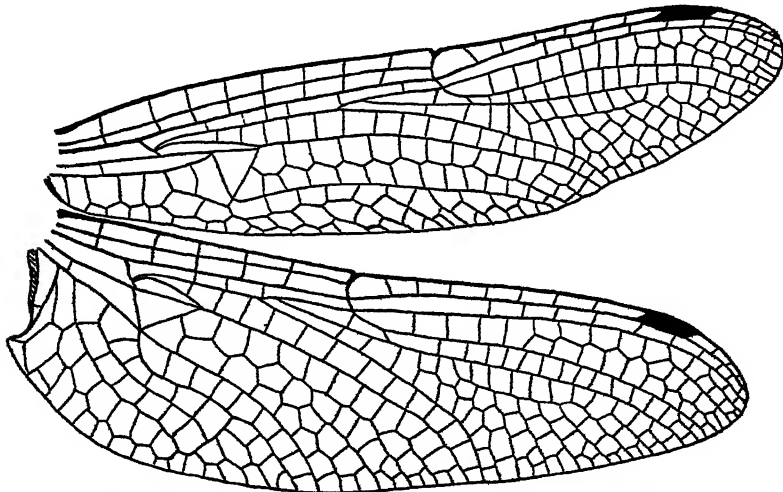


FIG. 30.—WINGS OF AN UNDESCRIBED SPECIES OF *Neocordulia* FROM BRAZIL.

advantageous arrangement of the veins has been attained, and reduction of unimportant and strengthening of important veins has proceeded until the Corduline wing has become the equal in efficiency of the best of insect wings and the superior of most others in its own family.

Among Libellulinæ proper, *Agrionoptera* and its nearest allies seem, on the whole, about as generalized as any (Plate XLIV, figs. 1-3) in having cubitus and anal vein very moderately angulated before the triangle in the fore wing, slight recession of the triangle and a short anal loop in the hind wing, and in the form of the wing as a whole.

Passing up the series we find the triangles progressing along lines we have already pointed out, the anal loop becoming foot shaped, and extending a support for the ever-widening anal area. When it was just becoming foot shaped, with a rudimentary "toe" meeting the hind

margin of the wing, the hind angle only moderately enlarged, specialization by reduction seems again to have dominated, producing a group of genera of which *Macrothemis* is a good exponent (Plate XLVI, fig. 1).

Then there is the important group of genera allied to *Libellula*, in which the branches of the media at their departure from the arculus are hardly fused, in which the narrowing and transverse elongation of the triangle and the deflection of the anal vein before the triangle have progressed very far, but in which only a very moderate reduction of cross veins has occurred (Plate XLVIII). The tendency of vein M_2 to become undulate is also a feature of this group.

There is also the heterogeneous group of genera allied to *Neurothemis*. These will at least agree in exhibiting the highest degree of vein adjustment together with the lowest degree of vein reduction to be found in the series (fig. 18).

At some point in this series not remote from *Celithemis* (Plate XLVI, fig. 2) may have set in the extensive reduction of cross veins characteristic of a very large number of genera allied to *Sympetrum*. (See Plate XLVI, fig. 3, and Plate XLVII, fig. 1.)

Another offshoot from near the same place, combining in a high degree both kinds of specialization, culminates in *Tramea* and its allies (Plate XLIX), which I regard the most specialized of Libellulinae, if not of all Odonata.

In the three last-mentioned groups there is a pretty adjustment of the second cross vein in the space between veins M_1 and M_2 in opposition to the proximal end of the radial supplement. Plates XLV and XLVI and fig. 2 of Plate XLVII will show its increasing definiteness and obliquity of position and the perfecting of the brace of which it is a third part, the other parts being the supplement and the oblique vein. A trivial character this? Indeed it is but a straw, yet it shows the way biologic winds blow.

ZYGOPTERA.

In this suborder we have again two families, the more generalized abounding, as before, in venational experiments (if I may so speak), some of which have been abandoned in recent times, the more specialized, being more homogeneous, characterized by a single principal trend in its wing development. The suborder as a whole has retained in recent times two primitive characters, in the similarity of fore and hind wings^a and in the total lack of supplements.

A. Calopterygidae.—There are four fairly distinct types of venation in this family, the most peculiar of which is represented by the fossil genus *Isophlebia* (fig. 31). In this type the hind wing was as much dilated at the base as in the Anisoptera, but by very different means.

^aFor this reason we figure in most cases but one wing.

The support for the expanded area developed upon vein Cu_2 , which was set off from vein Cu_1 by a long posteriorly directed stalk; secondary branches developed upon the posterior side of vein Cu_2 radiating to the wing margin. The anal vein did not join vein Cu_2 . The stigma was unbraced, and the wings were decurved at the tips, much as in the Petalurinae.

Among living Calopterygidae the tendency has been to match cross veins in lines parallel with the veins, thus producing a large number of interpolated sectors between the principal veins. This has been carried so far that few vestiges of the primitively hexagonal form of the cells remain. This has facilitated (perhaps we should say has accompanied) the throwing of the wing membrane into longitudinal furrows, and we find the sectors, in some forms, alternately convex and concave even to the distal margin of the wing. In those forms in which the furrowing of the membrane is most general we find the least tendency toward reduction of cross veins. Perhaps the fanlike folding of the membrane enabled it to resist bending and rendered unnecessary the differentiation of stronger veins for that purpose.

Epallaginae.—This group comprises the more generalized living members of the family, especially in the Legion Euphaea of de Selys, wherein the nymphs, so far as known, have paired gill filaments along the sides of the abdomen and have biramous mandibles. In this group the media tends to descend to the middle of the arculus, the nodus to recede moderately toward the base of the wing, and the quadrangle to lose the dividing cross vein. The quadrangle behaves similarly in both fore and hind wings. *Pseudophæa* seems, on the whole, as primitive as any genus of the group (fig. 32). *Rhinocypha* and its allies (Plate LII, figs. 1, 2, and 5) constitute a short lateral series. De Selys long ago showed, from characters not drawn from the wings, that they constitute a distinct subordinate group, but he did not point out the venational characters in which they are peculiar. These will be dis-

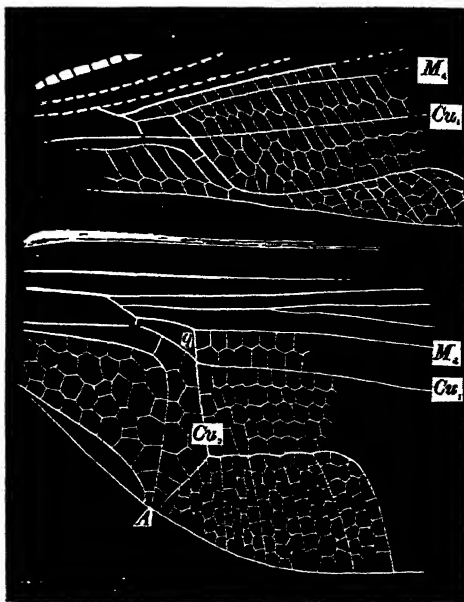


FIG. 31.—BASE OF WINGS OF *Isophlebia* (FOSSIL) IN PART AFTER DEICHMÜLLER.

covered by observing the behavior of the medial and cubital branches just after their separation. Just beyond the arculus veins M_{1+2} and M_3 separate by arching in opposite directions, forming a symmetrical fork. At the end of the quadrangle vein M_4 arches forward, vein Cu_1 sometimes arching with it, and vein Cu_2 arches backward, the two thus becoming set in opposing positions. Vein Cu_2 remains simple.

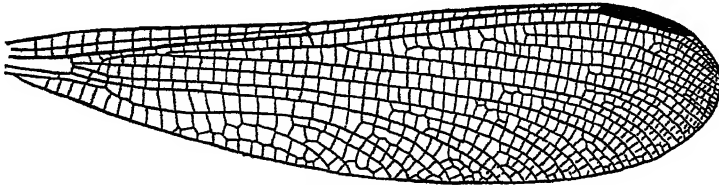


FIG. 32.—WING OF *Pseudophæa* sp.*

Throughout the group the stigma is well developed. In the space between veins M_1 and M_2 the longest of the sectors occupies an intermediate position, with shorter sectors on either side of it. The South American *Cyanocharis* (Plate LI, fig. 3) and *Dieterias* parallel the next following group in the fusion of vein M_{1+2} with the radius beyond the arculus, but in general the group is wholly lacking in those peculiar developments that characterize the two next groups.

Anisopleura, *Epallage* (Plate LI, fig. 2), *Bayadera*, *Cyanocharis* (Plate

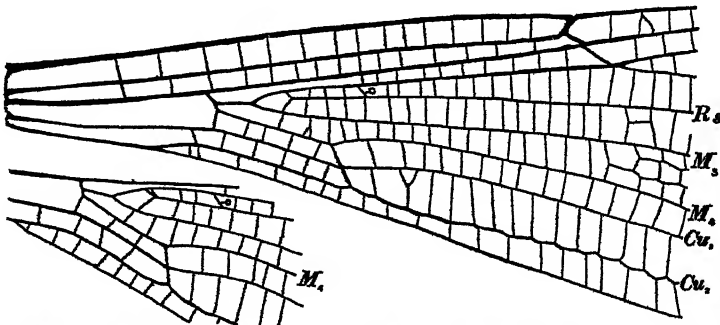


FIG. 33.—BASE OF FOREWING AND A BIT OF HINDWING OF *Rhinocypha* sp. o, OBLIQUE VEIN THAT WORKS THE POINT OF SEPARATION OF THE TRACHEA OF THE RADIAL SECTOR.

LI, fig. 3), *Diphlebia*, and *Philoganga* (fig. 44) illustrate a tendency toward the reduction of the base of the wing, and toward a considerable degree of vein differentiation throughout the membrane. The general result is analogous to that arrived at in the *Agrioninae*, discussed below.

Phaenocarpa.—In all this extensive group the media descends the wing and ascends from it in a line that is continued directly by the next vein. M_{1+2} arches strongly from its anterior side. The

fork is thus unilateral. In such genera as *Calopteryx* (fig. 34) and *Vestalis* (fig. 41), vein M_{1+2} reunites with the radius—completely fuses with it—only to separate again, after which its base appears as a cross vein and its distal end as a branch of the radius.^a The longest of the sectors between veins M_1 and M_2 closely parallels vein M_2 , with all the shorter sectors before it. The stigma tends to atrophy, more rapidly in the males. The quadrangle becomes unusually elongated, and is almost always convex on its anterior side and traversed by a number of cross veins, among which the identity of the typical one is never evident. Vein Cu_2 , just beyond the quadrangle, sets off a recur-

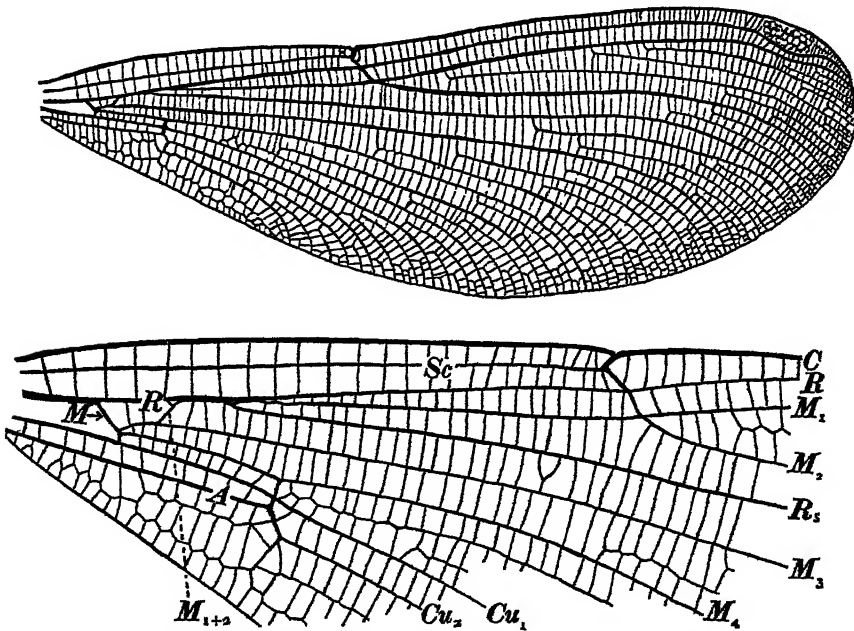


FIG. 34.—*Calopteryx maculata* BEAUVOIS, FORE WING AND BASE OF HIND WING.

rent branch for the support of the anal angle of the wing. The longer interpolated sectors tend to become attached as forks to the front side of the principal veins, and to become set in opposition to the same beyond the point of their attachment. *Vestalis* (fig. 41) illustrates well the culmination of nearly all of these tendencies.

A short side line includes only *Heterina* and *Lais*. The tendency in these is neither toward narrowing the wing at the base nor widening it beyond, but it is found evolving a unique transverse wing brace out of the bases of the cubital branches. (Plate LI, fig. 4.)

^aThus the radius gained its typical complement of branches, which enabled Redtenbacher to see in *Calopteryx* the form of wing from which all other Odonate wings might be derived! (Ann. k. k. naturhist. Hofmus. Wien, I, 1886, p. 167.)

The main line includes such forms as *Phaon*, *Mnais*, *Calopteryx* (fig. 34), *Nurobusis* (fig. 43), and *Vestalis* (fig. 41), in which the tendency is toward further vein adjustment without much further vein differentiation; attaching sectors to principal veins, and widening the wing distally, losing the stigma.

Thorinæ.—Another type of venation is found in *Thore* (fig. 35) and its allies, a very circumscribed group, comprising but a few South American genera. De Selys long ago set this group apart upon an excellent venational character, i. e., the media does not descend the arculus at all. To this may be added, the media departs from the arculus in line with its branch M_1 , while M_2 arches strongly from its posterior side, thus making a unilateral fork which is in position the

reverse of that of the *Vestalinæ*. The longest of the sectors between veins M_1 and M_2 closely parallels vein M_1 , with all the shorter sectors behind it. The basal curvature of vein M_4 makes the quadrangle concave anteriorly, and widest at the proximal end. There is an odd differentiation between quadrangles of fore and hind wings, that of the latter becoming twice the length of that of the former. In *Cora* (fig. 36) vein Cu_1 is almost simple; in *Thore*, *Euthore*, and *Chalcopteryx* it is symmetrically forked just beyond the quadrangle.

While in this group a form and general aspect of wing much like that of the typical *Calopteryginae* has been developed, a

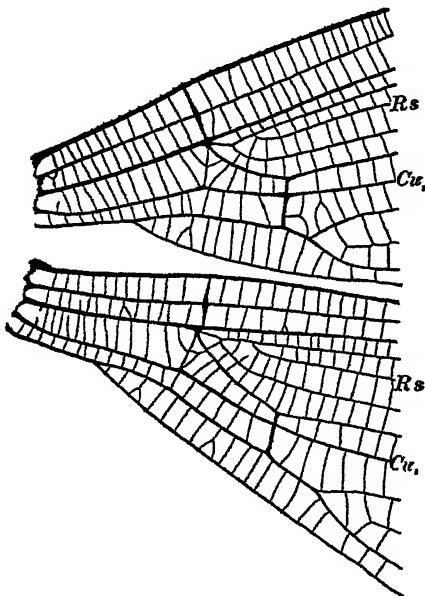


FIG. 35.—BASE OF WINGS OF *Thore gigantea* SEL.

comparison of the venational characters will show that the means employed have been almost diametrically opposite.

Some synthetic types.—In Plate XLI, fig. 3, there is shown a new figure of the much-discussed *Pulæophlebia superstes* Selys, from Japan—fore and hind wing of a female specimen, photo-enlarged. It is by no means easy to indicate the nearest relationship of this isolated species. Wing characters, like other characters, are contradictory. It agrees with the *Lestinae* and with the more generalized members of de Selys's heterogeneous and untenable Legion Podagrion in the form of the stigma and arrangement of cross veins behind it, and in the arrangement of the interpolated sectors in the space between veins M_1 and M_2 , and also in the obliquely placed quadrangles. It agrees further with *Lestinae* in the possession of a long bridge terminated

distally by an oblique vein. It differs utterly, however, in the form of the quadrangle of the hind wing, in the remoteness of the nodus from the arculus, and in the relation of the arculus to the hypertrophied antenodal cross veins

It agrees with generalized Gomphines in the last-named particular (compare with Plate XXXV, fig. 3), also in the general relations of bridge and oblique vein, and relations between arculus and nodus; but its quadrangles are undivided, and the hind margin of both wings is utterly unlike all known Anisoptera. In having a quadrangle that is obliquely placed, narrowing distally in the fore wing and widening distally in the hind wing and undivided in both, it stands entirely alone.

De Selys pointed out when he described the species that it showed striking resemblance to the fossil genus *Heterophlebia*—a genus, unfortunately, still insufficiently known. The quadrangle of the fore wing is, in fact, practically identical; and other parts of the wing, so far as known (whether there were hypertrophied antenodals is uncertain), are similar. But the quadrangle of the hind wing in *Heterophlebia* is very different. The cubitus, instead of being declined before the

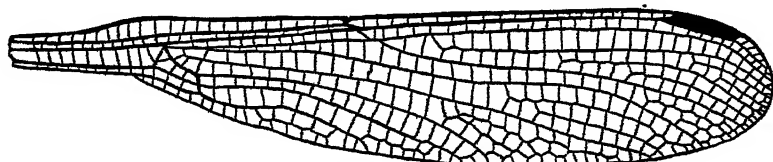


FIG. 36.—HIND WING OF *Cora incana* HAGEN.

quadrangle as in *Palæophlebia*, is bent at the middle of its posterior side, and from that point springs the dividing cross vein, as in Anisoptera; and the cross vein is declined so far that it rests against the upper end of the terminal cross vein of the quadrangle. There is yet another point of difference, of perhaps even greater importance. The bridge at its inner end is directed toward and attached to vein M_3 in *Heterophlebia*, whereas it turns the other way and attaches to vein M_{1+2} in *Palæophlebia* and in all living Odonata. (Although in the more generalized Gomphinae it is apparently symmetrically forked and not turned either way, whenever the fork happens to be unsymmetrical the leaning is seen to be toward the anterior side.) This is a difference of kind that is not to be passed over lightly.

Heterophlebia shares this peculiarity with one other genus, *Tarsophlebia*, likewise fossil, and it is a strong bond of union between them, of more importance than their rather striking differences, these being mainly differences of degree. *Tarsophlebia*^a has the quadrangles

^a *Libellula pannewitziana* Göppert belongs in *Tarsophlebia*, as will be seen by comparing Assman's figure of the type (Zeitschr. für Entomologie, I (n. s.), 1870, pl. 1, fig. 11) with fig. 3 of Hagen's plate cited herewith. *Heterophlebia jucunda* Hagen is not a *Heterophlebia* at all, nor even nearly related thereto.

even more obliquely placed, similar in fore and hind wing, without the dividing cross vein, and also without the basal cross vein, so that the quadrangle is confluent with the basal space, much as in the fore wing of fig. 38. The space between veins M_1 and M_2 is narrower also, with a different arrangement of interpolated sectors. These characters are well shown^a by Dr. Hagen, to whom we owe our best knowledge of these remarkable forms.

B. Agrionidæ.—This family is in essential agreement in all those venational characters which are most fundamental. The tendency throughout is toward extreme reduction of the anal area, making the wing "petiolate," and toward the matching of cross veins in transverse lines. The antenodal cross veins are almost always reduced to two. The nodus is greatly retracted and the quadrangle approximated to it. The media does not descend the arculus.

Lestinæ.—This group is quite unique in its own family in one character that has been already indicated, the radial sector fuses with vein M_2 for a long space, and an oblique vein and a very long bridge, reach-

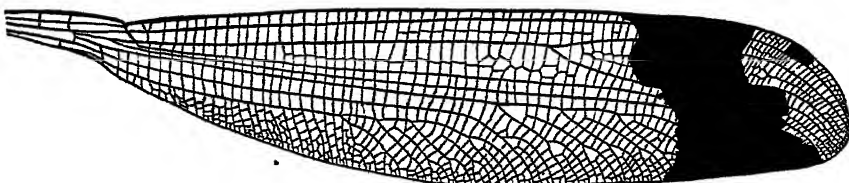


FIG. 37.—WING OF *Megaloprepus ceruleatus* DRURY.

ing more than halfway from the nodus to the arculus, are preserved. Nodus and quadrangle are but moderately approximated, and the matching of cross veins seems only begun (see Plates LI, figs. 6 and 7, and LIII, fig. 1).

Anormostigmatini.—In this curious group the radial sector leaves vein M_2 at the subnodus, and nodus and quadrangle are quite approximate. The part of the wing beyond the nodus becomes very greatly enlarged. The stigma is never braced; on the other hand, it becomes diffuse or is lost. Cross veins fall into transverse lines over a considerable part of the wing (Plate LI, fig. 8), especially in the smaller species, and interpolated longitudinal sectors in *Megaloprepus* (fig. 37) and *Microstigma* become attached to principal veins, of which they then appear as branches. In the space between veins M_1 and M_2 the longest sector parallels vein M_2 . Here the retraction of the nodus toward the base of the wing and the migration of the base of vein M_2 outward toward the stigma have attained their maximum. These are among the most grotesquely specialized of living insects.^b

^a *Palaentographica*, XV, 1866, pl. II.

^b Since this paper was written the venation of the genus *Thaumatooneuria* has become known to me through Dr. Calvert's figures (*Biol. Centr. Amer., Neur.*, pl.

Agrioninae.—This group contains a larger number of genera and species than any other of equal homogeneity of venational characteristics. The radial sector leaves vein M_2 near the nodus (sometimes following vein M_2 in its migration along vein M_1 toward the stigma), and nodus and quadrangle tend to close approximation. Cross veins are generally matched in transverse lines, and the stigma is generally strongly braced.

Two minor lines of development may be briefly indicated in passing: One, tending toward the loss of the branches of the cubitus—*Pulæmna* (Plate LIII, fig. 2), *Platysticta* (Plate LIII, fig. 3), *Disparoneura* (Plate LIV, fig. 2), *Idioneura* (Plate LIV, fig. 3), and *Ctenoneura* (Plate LIV, fig. 4); and a second, including nearly the whole of the group which lacked this tendency, but in which nodus and quadrangle become more and more approximate, and the veins M_2 , R_s , and M_3 migrate separately along vein M_1 from their accustomed places toward the stigma (Plate LIII, figs. 4, 5, and 6), or in which progress has consisted in

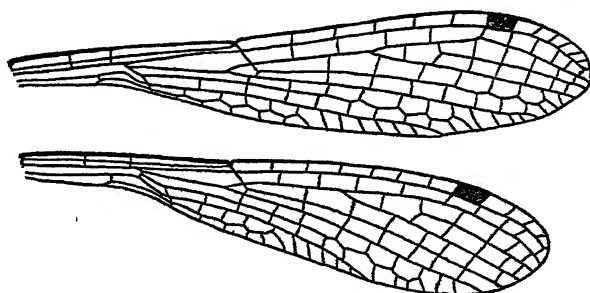


FIG 38.—WINGS OF *Hemiphysbia mirabilis* SELYS.

mere reduction of cross veins and better matching of them in transverse lines, and in the perfecting braces at the nodus and elsewhere.

This series furnishes in the genus *Hemiphysbia* (fig. 38) a striking example of the loss of a cross vein that is elsewhere very constant—the

III, figs. 16 and 21). I think *Thaumatoneuria* belongs here; it has all the essential venational characters of this group, and surely these are sufficiently distinctive. It is more generalized than *Megaloprepus*, in that vein M_2 has made less progress along vein M_1 away from the nodus, some vestiges of the primeval extra antenodal cross veins are preserved, most of the interpolated sectors are still unattached to the veins, and the stigma is larger and better preserved. It is a curious and probably significant fact that in the two series of Zygoptera—*VESTALINÆ* and *ANORMOSTIGMATINÆ*—in which the long sector between veins M_1 and M_2 parallels M_2 should be the only ones in which the stigma progressively dwindles and disappears. It is conceivable that the stigma might lose importance for want of the support that this sector would give if approximated to it at the apical bend. Perhaps the concavity on the costa in *Mecistogaster lucretia* (Plate LI, fig. 8) and the conjoining and the sharp bending backward of the veins behind it may be a unique way of supplying such deficiency of bracing, preserving the utility of the stigma as a weighted striking point toward the end of the cutting edge of the wing.

cross vein forming the lower end of the arculus.^a This is entirely absent from the fore wing of the males; it is present, however, in the hind wing of both sexes, and often also in the fore wing of the female. The loss of this cross vein has resulted from a shift of other veins and a consequent shift of responsibility in stress of wing stroke. The symmetrical fork formed at the separation of veins M_{1+2} and M_3 (elsewhere always unilateral unless the fork be very narrow) and the upward bend of the anal vein at its departure from the hind margin, to meet the cubito-anal cross vein and the very considerable progression of the arculus beyond the second antenodal, are the visible signs of the readjustment which has relieved the basal side of the quadrangle of its former responsibility.

It is needless to remark after observing the form of the wings, that among the Zygoptera there are no strong flying species. Most of them fly so low over the surface of the water that their winged enemies can not safely descend to their level. The Lestinae live amid sheltering semiaquatic vegetation. Vestalinae seem not to be desired for food; their coloring may suggest that they are not good eating. The action of the wings is that of sculling solely; only the distal portion of the wing which takes the active part in insects' flight is well developed. There is no soaring basal aeroplane, as in the Anisoptera, to support the body passively by merely gliding upon the resistant air.

I offer below a scheme of subfamilies for the order, which seems to me to be, in the light of the evidence that present knowledge of venation affords, an approximation toward equivalent values for these groups. The weakest distinction seems to me to be between the Cordulinae and the Libellulinae; the most doubtful association of recent forms that of *Cordulegaster* and *Petalia* together. The fossil groups seem not only more isolated but also more strongly characterized structurally than the others.

Anisoptera.	Æschnidae.	1. Gomphinae (recent and fossil).
		2. Petalurinae (recent and fossil).
		3. Stenophlebinæ (fossil).
		4. Cordulegasterinae (recent and fossil).
		5. Chlorogomphinae (recent).
		6. Æschinae (recent and fossil).
		7. Æschniidinae (fossil).
	Libellulidae.	8. Macromiinae (recent).
		9. Cordulinae (recent and fossil).
		10. Libellulinae (recent and fossil).
Zygoptera.	Calopterygidae.	11. Heterophlebinæ (fossil).
		12. Palæophlebinæ (recent).
		13. Epallaginae (recent and fossil).
		14. Vestalinae (recent).
		15. Thorinae (recent).
	Agrionidae.	16. Lestinae (recent and fossil).
		17. Agrioninae (recent and fossil).

^aThis arculus cross vein is absent in the fossil genus *Tarsophlebia* as already noted.

V. DYNAMIC CONTROL IN VEIN EVOLUTION.

So numerous are the evidences that veins are largely controlled in their development by purely mechanical causes, it would be impossible, were it not also undesirable, to enumerate them here. We have come upon parallelisms at every turn. We have seen essentially the same mechanical feature of efficient wings made out of homologically different things repeatedly. But the adult wing is only a machine, and this was to have been expected. It remains now for us to notice a few features which indicate the operation in these wings of far-reaching mechanical principles.

It is not at all surprising that we should find the first regular form taken on by the areoles of the wing to be hexagonal. The hexagon is nature's favorite plane figure, and there is a good mathematical reason why it should be so: economy is a good biological reason. We have

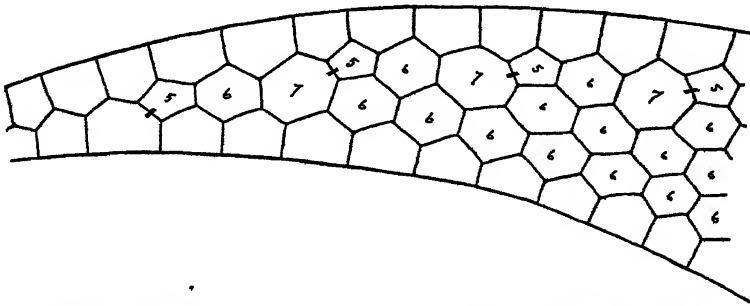


FIG. 39.—DIAGRAM ILLUSTRATING A TYPICAL (HYPOTHETICAL) ARRANGEMENT OF THE AREOLES IN ONE OF THE WIDER SPACES OF THE WING.

already shown that bordering, straight veins eliminate certain angles of the hexagons, converting them into pentagons and rectangles. We pass now to notice the arrangement of the areoles in the wider areas of the wing, where least influenced by the veins. The spaces between principal veins or branches of veins, widening distally, are filled proximally by a single row of rectangles or by a double row of alternating pentagons. Actual hexagons are present only when there are three or more rows of areoles included. The first cell in each added row is typically a pentagon, which presents an angle to the cleft between the separating rows of areoles and a straight side to meet succeeding hexagons. A triangle or a heptagon would of course do the same, but not with so little disturbance of surrounding hexagons. Opposite the initial pentagon an areole in one of the preexisting rows acquires an additional side, becoming a heptagon (or a hexagon, of course, if it were first a pentagon). Thus pentagon and heptagon are complementary, and together initiate new rows of cells with the least possible disturb-

ance of the series of hexagons. The accompanying diagram (fig. 39) shows the ideal cell arrangement.^a

I hasten now to add that a perfectly typical arrangement of the areoles throughout a single entire space in a dragon-fly wing I have not found, although it is easy to find in many of the more generalized

forms ample evidence of the operation of the principle. The accompanying drawing (fig. 40) of parts of actual wings will serve for illustration. I have made no hunt for better, for these show, also, why the typical condition is so early lost. Accessory tracheal branches penetrate along broken lines of cross veins, bringing them into line; then supplements are superadded, and the havoc of the hexagons is complete. Enough of the typical arrangement for recognition is to be looked for only in wings lacking strong accessory tracheal branches and supplements.

Tissue cells often appear hexagonal in section, and when crowded into similarly shaped areas, often behave as do these areoles of dragon-flies' wings. The histologist who looks over the plates accompanying this paper will not fail to see here and there groups of areoles showing conformation entirely comparable to familiar images of tissue cells.

Coming now to some points which have to do probably only with wings and with aerial navigation, we recall that a form of wing broad at base and narrow and pointed at the apex, well known for its efficiency in insects generally, we have seen developed twice upon two very different plans, culmi-

minating in *Anax* and *Tramea* respectively. Both have adjusted the wing apex to a degree of rigidity on the costal margin, and of pliancy behind it, which gives the greatest resultant in forward motion for

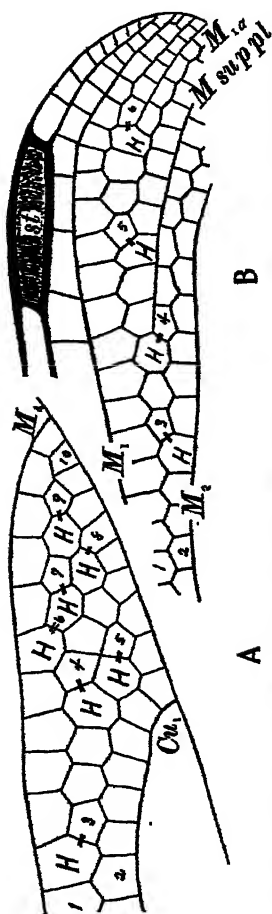


FIG. 40.—DRAWING OF PARTS OF WINGS, SHOWING THE ACTUAL CELL ARRANGEMENT. A. *Epigomphus paludosus*; B. *Agrion picta* insignis. INITIAL CELLS ARE NUMBERED IN THE ORDER OF THE INTRODUCTION OF THEIR SEVERAL ROWS; HEPTAGONS ARE MARKED WITH AN H.

^aDr. R. T. Jackson has shown (Bull. Geol. Soc. Amer., VIII, 1896, p. 164) that the interambulacral plates of sea urchins are potential hexagons, that the border rows are pentagons—hexagons, with one angle eliminated, as here—and that pentagon and hexagon together initiate new rows of plates. Practically the only difference between the typical arrangement of these areoles and that of the interambulacral plates, as shown by Dr. Jackson, arises out of the difference in the shape of the areas to be occu-

rapid vibration in air. Both have developed at the wing base close against the body a broad soaring surface, an aero-plane, which in rapid flight supports the weight of the body upon the resistant air. Wings of broad base and pointed apex are characteristic of other insects of rapid flight, but in most others (hawk moths, cicadas, bees, etc.) the two wings are united and used as one. The basal expanse is secured by shortening the hind wing and directing it posteriorly. Different as are the wings of birds, these also are sharply pointed in the species of swiftest flight (ducks, swallows, etc.). I can not state the aeronautic principle involved in the pointed wing, but I ask no better proof of its existence than is furnished by the efficiency of such a wing and its repeated independent development.

In the arrangement of the principal veins we have called attention to the fact that the Odonata, except in the earliest stages, differ very widely from all other insects. There is hardly a group from which they differ more in fundamental plan than the Ascalaphidæ. The latter

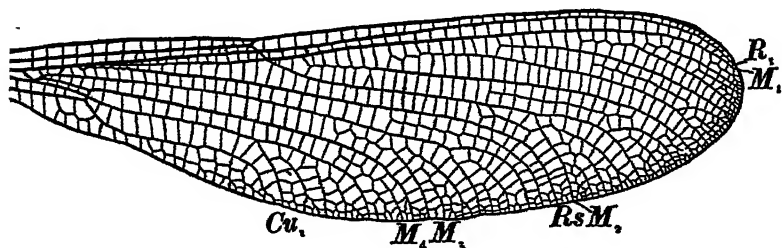


FIG. 41.—WING OF *Vestalis amoena* SELYS.

have the radial sector enormously developed and in its accustomed place, occupying the central field of the wing, while the media is greatly reduced; in the Odonata the development of these parts is reversed and the radial sector is out of place. The differences at the costal border of the wings is so great that I will only invite comparison of the Ascalaphid wing in Plate XXXVI, fig. 2, with the wing of any dragon-fly. If now, without reference to homologies, we examine this wing of *Ulu*, we will see in it familiar mechanical features. (1) From the stigma there extends obliquely across the wing tip to the posterior margin a vein which occupies the position, and probably performs the function, of the vein M_{1a} in the Odonata. (2) Intersecting the wing obliquely, so as to mark off a basal posterior third

pied in the two cases. In the echinoderm the area is symmetrical, and new rows are introduced alternately on the two sides. In the dragon-fly wing the space is unilateral, as shown in the diagram, and the rows are introduced chiefly upon the anterior, convex side. The principle is the same; but we should not omit to notice how different are the two things whose arrangement it controls—in the one case, solid plates; in the other, a mere rim of solid matter surrounding an almost empty space.

of it, are two parallel veins, separated by a single row of cells, analogous to the veins M_3 and M_4 in the Odonata. (3) Behind these is a transverse bracing of the basal part of the wing, analogous to the triangle in the Anisoptera, and to the special braces beyond the quadrangle in *Luis* and *Heterina*.

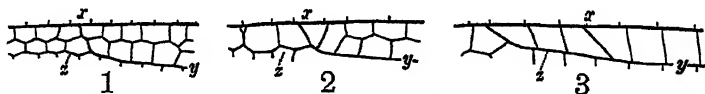
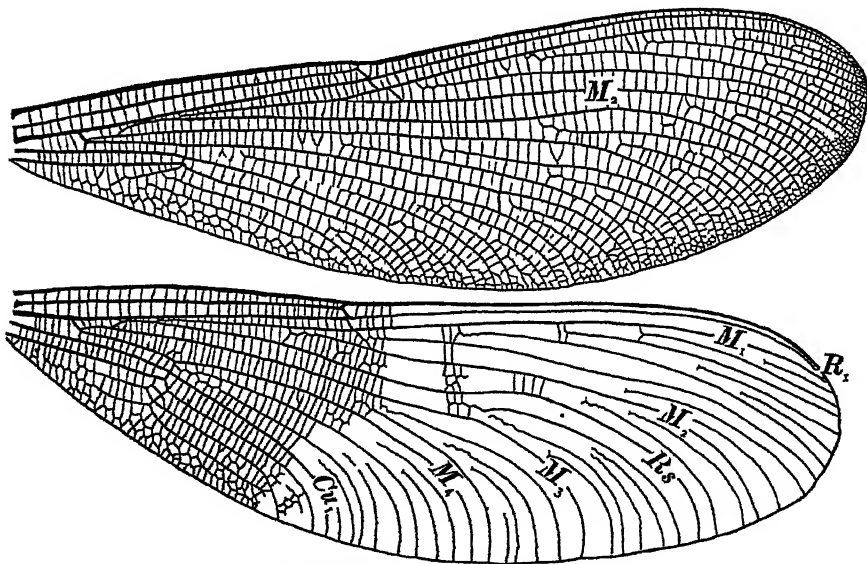


FIG. 12.—DIAGRAM (HYPOTHETICAL) OF THE EVOLUTION OF A BRACE FOR A UNILATERAL FORK; 1, 2, 3, SUCCESSIVE STAGES.

We have shown that the brace vein to the stigma and the supplements, etc., are independently developed in several groups. We have shown that the sectors interpolated between the tips of veins in several groups have become attached to veins, making the latter appear forked. Our illustrations of this were veins R_s in the Aeschninae, and veins M_3 and M_4 in *Chalcopteryx* (fig. 22); but if one wishes to see how far



(fig. 42) shows how such a brace is evolved out of the boundaries of ordinary cells.

This brace joins the main vein with the elbow in the branch, thus correcting the mechanical weakness of the unilateral fork. Aside from the bridge, such a brace is developed in *Rhinocypha* (fig. 33), extending the attachment of vein R_s along vein M_{1+2} toward the arculus;^a also, in *Chalcopteryx* and many Calopterygineæ; again, at the proximal end of vein M_2 in *Neurobasis* (fig. 43) and a few closely related genera,^b as it was, also, in some fossil species referred to *Stenophlebia*; again, at the proximal end of vein M_{1a} in *Nusäeschna pentacantha* (Plate XXXIX, fig. 1) and many other Anisoptera, in which, however, it is, as a rule, imperfectly developed or not developed at all; and again in *Philoganga montana* (fig. 44). The bridge itself seems to be still extending proximally in some Lestinæ (Plate LI, figs. 6 and 7, and LIII, fig. 1), its slender proximal end being often unattached to vein M_{1+2} .

Here we have strong side light upon the early history of that most distinctive peculiarity of dragonfly wings, the crossing of the radial

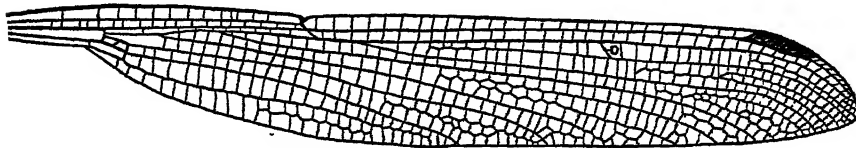


FIG. 44.—WING OF *Philoganga montana* SELYS.

sector over two branches of the media and the development of the bridge. Why this crossing should ever have taken place is left entirely unexplained. That it was established very early in the history of the group is indicated by its occurrence in very early nymphal life, crossing being no longer possible after the internal fusion of the hypoderm cells to form the tracheal channels. But, once across, it formed a weak unilateral fork upon the posterior side of vein M_2 , while occupying a field where strong developments were possible. Hence a strong bridge was evolved for its support, and the development of the bridge doubtless followed the lines we have just indicated. The proximal end of the bridge in most living species joins vein M_{1+2} directly, but in most Gomphinæ it appears as if forked, and in the fossil Heterophlebinæ it joined vein M_2 directly.

In the singularly isolated fossil genus *Stenophlebia*, whose venation has been figured in a very detailed manner by Hagen,^c there is a con-

^aIt will be remembered that the trachea R_s here springs directly from trachea M_{1+2} . The oblique vein (o' , fig. 34) marks the place of its origin; on the proximal side is the added brace (br').

^bIt will be observed that this brace is better developed in the fore wing than in the hind in *Neurobasis*; similarly, the other brace just mentioned for *Chalcopteryx*; two further examples, therefore, of unequal development of fore and hind wings.

^cPalæontographica, XV, pl. III, fig. 1.

dition of the crossing of the radial sector so curious one hesitates at attempting to explain it on the ground of published figures that were drawn without ontogeny in mind. It looks as if, a little beyond the nodus, the radial sector had crossed over but one branch of the media and had then developed a short supporting bridge; as if a stage a little less primitive than that shown for tracheæ in fig. 1, *B*, had been the permanent condition in this genus. But perhaps the interpretation of homologies given by Hagen is correct (naturally it is the only one that would occur to him), in which case the bridge is developed as a support to vein M_2 , and the radial sector is shifted proximally at its base—a very curious state of things for Anisoptera! And *Stenophlebia* is distinctly anisopterous, notwithstanding its lack of differentiation between fore and hind wing. Aside from the characters just discussed, it is a very curious form in its sickle-shaped wing tips, its dislocated nodus with the subcosta descending upon the radius, its undifferentiated subtriangles, its triangles transversely placed in both fore and hind wings, and its remarkably developed trigonal supplements.

If I mistake not, it is to the readjustment of stress after the crossing of the radial sector that is due the curious bendings of veins M_3 and M_4 in many fossils (notably in *Cymatophlebia*), in some living forms of ancient aspect (*Phyllopetalia*, fig. 26, and *Chlorogomphus*, fig. 24, etc.), and in some of the more generalized members of groups at present dominant (*Gomphæschia*, Plate XXXVII, fig. 1; *Dilymops*, Plate XLI, fig. 2, etc.). This bending is very different from the undulation of the radial sector in certain Libellulinae. This is primitive, defective, and early disappears in the dominant groups, or becomes transformed into something very different and more useful. That other is recent, local, and is but one among several factors in the bracing of the wing area in which it occurs.

When vein *Cu* became unilateral on its posterior side, the weakness of this fork was corrected by the apposition of the distal end of vein A_1 .^a

It must be borne in mind that dynamic control in vein development, dynamic genesis, or whatever we call it, may be but the result of the natural elimination or subordination of those variations which do not tend toward the mechanical perfecting of the machinery of flight.

VI. SUMMARY AND CONCLUSIONS.

1. In the course of this study I have come upon numerous manifestations of developmental dynamics:

(a) I have shown the operation in dragon-fly wings of far-reaching

^aThis type of bracing, which is so confusing of homologies as generally to require ontogenetic study for their unraveling, is of very common occurrence near the apex of grasshopper wings.

mechanical principles, in accordance with which the potentially hexagonal areoles of the wing are arranged in the spaces they must occupy, as are other wholly unrelated potentially hexagonal structures in other organisms.

(b) I have shown that there is developed in this group, several times independently, a form of wing that is elsewhere most efficient—a wing broad at base and long and pointed at the apex, rigid at the front and pliant toward the rear margin—a wing combining the principle of the aeroplane with that of the scull.

(c) I have shown that the development of wing braces follows strictly mechanical principles, analogous braces being repeatedly developed out of homologically different parts. Many examples have been cited within the order, and one without, in the comparison of Odonate and Ascalaphid wings.

2. In this study I have indicated processes concerned with the development of these wings which will probably be found affecting the evolution of insect wings in general:

(a) I have shown that there are two kinds of specialization in operation throughout the order—vein shifting, concerned with securing advantageous position of the parts, and vein differentiation, concerned with the strengthening of the most important veins by an economical use of all strength-giving wing material. The former alone seems to have been made use of in venational studies hitherto; the latter is often a more sure criterion of the degree of specialization.

(b) I have offered a hypothetical explanation of the progressive differentiation between veins and membrane.

3. In the study of dragon-fly wing venation only the comparative anatomy of the adult wings has been drawn upon hitherto. I have added the ontogenetic method, beginning my study of the veins with that of their antecedent tracheæ. I have found this method to furnish most satisfactory evidence as to what was the primitive position of the veins in almost every part of the wing for all the principal groups of the Odonata. This, followed by careful study of adult wings, both recent and fossil, has enabled me to make some slight contributions to Odonatology proper:

(a) I have for the first time homologized in detail the parts of the dragonfly wing with those of the wings of insects of other orders, applying the simple Redtenbacher terminology, retaining the special terms already in use for parts not represented in other orders, simplifying some of them, and adding a few new terms for parts not hitherto designated by name.

(b) Homologies within the order have been pretty well understood for a long time, thanks to the labors of many able entomologists, among whom may be mentioned Hagen, Walsh, and especially that lifelong student of this order, Baron de Selys Longchamps. In 1893,

Calvert^a critically reviewed and correctly stated the matter, adding some results of his own. I have been able to extend the study of homologies in a few parts, such as the region of the bridge, the supplements, the anal area, and several spaces in which special bracings occur. In these places occur the most distinctive venational features of the smaller groups.

(c) Incidentally, I have shown something of the relative values of the different characters that have been used hitherto to distinguish groups. Characters drawn from the form and position of the arculus and triangle and other strong braces have always proved reliable, but it is very clear that antenodal and other cross veins have been greatly overvalued, and it is equally clear that many other more important venational characters have not been noted. It is not the presence or absence of weak cross veins, but the position and relations of those that strongly brace the wing; not the number of rows of areoles that may fill a wide area, but the course of principal veins and of their supporting sectors, that are of first importance.

(d) I have been able to indicate many new minor lines of specialization within the order, and to add new and corroborative evidence to some lines already indicated by Kolbe, Karsch, and Calvert. Owing to the presence in these wings of a number of characters which may vary independently, for each of which primitive conditions are easily determined, and in each of which the several courses of specialization are easily traced, I have often been able to put forth conclusions based on the cumulative testimony of several parts. I have attempted to find such genealogic evidence as is preserved—not to create any—and have been content to drop, without any suggestion that might hinder future studies, cases in which evidence from wings alone seemed insufficient. But I have not hesitated to indicate relationships when these seemed well evidenced by the facts of venation.

4. Following my morphological study of the order with a review of its members, as distributed among the several families and genera, I mention some facts which might themselves serve independently as biological indications of specialization:

(a) A large group of closely related species, numerically dominant in its proper range, indicates the culmination of some type of specialization. This may affect either the nymph or the adult or both.

(b) Small and scattered genera, which include only the more rare and delicate species, are pretty apt to be the conservators of numerous generalized characters. However, since development has not stood still with any species, certain marks of specialization will also always appear.

^aTrans. Amer. Ent. Soc., XX, pp. 162-169. The papers therein discussed, together with the few referred to in footnotes to these pages, constitute the whole of the useful literature of Odonate venation, hence no bibliographic list is hereto appended.

(c) Set apart from any group its dominant forms and there will remain those members of it which most closely ally the group with its neighbors.

5. What of genealogies based on external characters?

In this paper we have been dealing almost entirely with external characters—superficial characters, viewed from the standpoint of the physiologist. But hard parts, though dead, are the enduring mold in which the living being is cast, and represent the outcome of its struggle with environment. Therefore we may make more use of the principle of natural selection than is usually possible in the ordinary morphological work, having frequent recourse to the almost axiomatic principle that “useful structures once acquired will not be lost (other things being equal) in a single series, unless replaced by more advantageous structures.” This is but a partial paraphrase of the more usual statement of the principle of natural selection, which may itself be condensed into three words—utility determines survival.

In order to apply this principle, we have, therefore, to know that the structures whose development we are tracing are useful structures. The proof of their utility may be derived from various sources. Take, for illustration, the brace to the stigma, which, we have seen, is developed from an ordinary cross vein:

(a) Its efficiency may be demonstrated mechanically. This I have not done, though it would not be difficult.

(b) It may be demonstrated experimentally. This I have done (on *Agrioninae*) by cutting out a little piece of the brace in each wing and noting the resulting weakening of flight.

(c) It is demonstrated biologically by the success in life of those forms which possess the brace. They are the dominant members of their respective groups, being in numbers of species and of individuals vastly in the majority. With creatures absolutely dependent on their wings in mating, in feeding, and in escaping their enemies, this is ample demonstration of the efficiency of the wings as a whole, and, incidentally, of each part that is found here better developed than in the less successful members of the series. While this proof is less specific, while one may not learn from it the contribution any one structure has made to the excellence of the wing as a whole, it is the real proof after all.

(d) I ask no better proof of the efficiency of any structure than is furnished by its repeated independent development in those forms which are acknowledged to be the most specialized members of the several groups.

By these means we may arrive at some knowledge of the efficiency even of structures about whose use we know so little as we do of the several parts of the insect's wing.

The application of the principle above stated furnishes the means

for critical determination of the course of specialization. For instance, forms with unbraced stigma are not to be derived directly from other forms which have the stigma braced; and so for every other useful structure; and so for every stage in the development of each. When the records of the several parts (or of the several organs) agree, the arrangement of forms is simple enough. When they conflict—when one form is specialized in this character and the other in that—we are dealing with different lines of development, and the group is to be divided on the most ancient or fundamental character concerned. When a number of characters in disagreement seem of equal importance, with no preponderance of evidence in favor of any one as a basis for a first division, only a tentative arrangement of the groups, subject to change after study of other parts (or organs), is possible. Even when a number of characters are studied and all are in accord, and a small group may be arranged with confidence, evidence from additional parts or organs may show the group to be somewhat less homogeneous than it at first appeared. It is obvious that in a genealogic study that organ or part is most valuable which possesses the largest number of characters of which one may be sure he knows both primitive form and secondary conditions and characters, which may vary independently.

It is probable that every single functional organ exhibits developmental features that are characteristic of even the smallest groups, and that the true record of relationships is preserved in every organ if we could but read it. While a classification based upon a single organ is necessarily incomplete, the necessity for the incompleteness arises out of our inability to interpret or even to see the significant features. While a classification based on one organ is necessarily incomplete, it is not necessarily incorrect. It will at least be self-evident that the classification which must prevail because it expresses the concurrent record of all the parts will be hastened by the serious and careful study of each character singly, to determine the facts of its origin, development, and utility, and to trace these facts to their logical and necessary conclusions.

6. This is only a beginning of what should be done in the study of the venation of the order. The distinctive group characters need to be known, not for whole wings alone, but for every part of the wings. The results worked out in this paper are not specific enough to meet at least three immediate, practical needs. It is frequently necessary to determine fragments of wings:

(a) In food studies.

(b) In the study of unknown nymphs, whose developing wings contain the full outline of the venation of the imago. Such wings are often imperfectly preserved and are to be removed only in fragments. Their correct determination makes the most exacting demands on one's knowledge of venation.

(c) In the study of fossils, that are oftener fragmentary than otherwise and that present no other characters so well preserved. From the standpoint of pure science, the need of better knowledge is greatest here. The present systematic arrangement of the known fossil Odonata is a miserable jumble, and some statements that have been drawn from it in a number of books and papers on geographic distribution are quite misleading. Instances have already been cited of fossil forms that are referred to the wrong suborder. There have been some greater and many lesser unnecessary errors of reference. *Libellulium kaupii* Westwood is probably not a dragonfly at all, while *Hemero-boides giganteus* Buckman is a dragonfly of the subfamily *Isophlebinæ* (as may be seen by comparing Buckman's figure with the forewing of fig. 31), and not a huge hemerobian, as has been supposed. *Libellulium agrius* Westwood belongs in the *Æschnidæ*, being in every detail that Westwood figured diametrically opposed to *Libellulidæ*. *Libellulium antiquum* Brodie belongs in the *Æschnidiinæ*, and so also does the *Æschna flindersiensis* Woodward. The only fossil *Æschna* that seems to fit that name in the modern sense of it is *Æ. solida* Scudder. *Æschna separata* Scudder and *Æschna metis* Heer, especially the latter, which was improperly removed to *Anax* by Hagen, will go in *Hoplo-næschna*. *Æschna perampla* Brodie and *Æschna hageni* Heer, judged by poor figures, will hardly go in the *Æschniinæ*. *Stenogomphus carletoni* Scudder,^a which was independently determined by the two most distinguished students of the Odonata, de Selys and Hagen, to be nearest *Gomphoides stigmatus* (Plate XXXIII, fig. 2) among living forms, and which stands as the only known American fossil Gomphine, is in fact a *Libellulid* in every line, and had the hind wing been preserved no one would have thought it a Gomphine.

While it would be manifestly impossible, owing to defective preservation, to refer fossils, in most cases, to genera of such thin cleavage as modern practice allows for recent species, it is very obvious that a new study of the types of the older authors would help much toward a better arrangement of our system. New figures of these are especially needed. Mr. Scudder's figures are the only ones that I have found entirely reliable. All others show omissions or alterations of unnoticed characters of critical importance. For instance, the oblique vein, even in Hagen's drawings, is rarely shown. This is not surprising, so long as it was regarded merely as one of a row of cross veins; but it is disconcerting in a study made from the ontogenetic standpoint. When the structural characters that are actually preserved by fossils already in collections have been fully interpreted, we shall know much more concerning the history of the group. Generalisations can not safely proceed faster than the development of real knowledge.

^a Bull. 93, U. S. Geol. Surv., pp. 12-15, pl. 1, fig. 1.

EXPLANATION OF PLATES.

PLATE XXXI. Nymphal wings (photomicrographs).

- Fig. 1. Wings of *Gomphus descriptus* Banks, nymph full grown.
2. Wing of *Lestes rectangularis* Say, grown nymph, showing the radial sector attached to the median trachea.
3. Portion of hind wing of young nymph of *Anax junius* Drury, previous to the development of any veins, showing the first indications of bridge, triangle and anal loop.

PLATE XXXII. Nymphal wings (photomicrographs).

- Fig. 1. Small portion of wing of a nearly grown nymph of *Anax junius* Drury, with veins developing, showing the formation of the radial supplement (*R. suppl.*) and of the brace vein between veins M_3 and M_4 .
2. The basal part of the fore wing of a nymph of *Lanthus parvulus* Selys, showing the formation of the arculus and the triangles.
3. The nodal region of the same wing, showing the formation of the bridge and the oblique vein.

PLATE XXXIII.

- Fig. 1. Wings of *Gomphus dilatatus* Rambur.
2. Wings of *Gomphoides stigmatus* Say.
3. Wings of *Aphylla producta* Selys.

PLATE XXXIV.

- Fig. 1. Wings of *Cyclophylla diphylla* Selys.
2. Wings of *Progomphus obscurus* Rambur.
3. Wings of *Gomplidia* sp?

PLATE XXXV.

- Fig. 1. Wings of *Gomphus vulgatissimus* Linnaeus.
2. Wings of *Hemigomphus ochraceus* Selys.
3. Wings of *Lanthus parvulus* Selys.

PLATE XXXVI.

- Fig. 1. Wings of *Tuchopteryx thoreyi* Selys.
2. Wings of *Uta* sp? (from Brazil).
3. Hind wing of *Hemianax pluppiger* Burmeister.

PLATE XXXVII.

- Fig. 1. Wings of *Gomphaschna furcillata* Say.
2. Wings of *Basiaschna junata* Say.
3. Wings of *Boyeria irene* Fauscombe.

PLATE XXXVIII.

- Fig. 1. Wings of *Hoplonaschna armata* Hagen.
2. Wings of *Brachytron pratense* Müller.
3. Wings of *Eschnophlebia anisoptera* Selys.

PLATE XXXIX.

- Fig. 1. Wings of *Nasiaschna pentacantha* Rambur.
2. Wings of *Staurophebia reticulata* Burmeister.
3. Wings of *Gynacantha trifida* Rambur.

PLATE XL.

- Fig. 1. Wings of *Eschna californica* Calvert.
2. Wings of *Eschna ingens* Rambur.
3. Wings of *Anax junius* Drury.

PLATE XLI.

- Fig. 1. Wings of *Synthemis brevistyla* Selys.
2. Wings of *Dolynops traversa* Say.
3. Wings of *Palucophlebia superstes* Selys, female.

PLATE XLII.

- Fig. 1. Wings of *Neocordulia androgynus* Selys.
2. Wings of *Orygaster curtisi* Dale.
3. Wings of *Hemicordulia tau* Selys.

PLATE XLIII.

- Fig. 1. Wings of *Gomphomacromia paradoxa* Brauer.
2. Wings of *Nannothemis bella* Uhler.
3. Wings of *Perithemis domitia* Drury.

PLATE XLIV.

- Fig. 1. Wings of *Agrionoptera insignis* Rambur.
2. Wings of *Anatya guttata* Erichson.
3. Wings of *Raphisnia bispina* Hagen.

PLATE XLV.

- Fig. 1. Wings of *Pseudophlebia minima* Kirby.
2. Wings of *Diplacodes parrula* Rambur.
3. Wings of *Mesothemis simplicicollis* Say.

PLATE XLVI.

- Fig. 1. Wings of *Macrothemis celeno* Selys.
2. Wings of *Celithemis eponina* Drury.
3. Wings of *Leucorhinia intucta* Hagen.

PLATE XLVII.

- Fig. 1. Wings of *Pachydiplax longipennis* Burmeister.
2. Wings of *Ephialatia longipes* Hagen.
3. Wings of *Palliothemis lineatipes* Karsch.

PLATE XLVIII.

- Fig. 1. Wings of *Orthemis ferruginea* Fabricius.
2. Wings of *Belonia uniformis* Kirby.
3. Wings of *Libellula pulchella* Drury.

PLATE XLIX.

- Fig. 1. Wings of *Schizopyga luctifera* Selys.
2. Wings of *Tauriphila iphigenia* Hagen.
3. Wings of *Tranea onusta* Hagen.

PLATE L.

- Fig. 1. Wings of *Trithemis* sp?
2. Wings of *Uracis* sp?
3. Wings of *Pantula flavescens* Fabricius.

PLATE LI.

- Fig. 1. Wings of *Pseudophæa ochracea* Selys.
2. Wing of *Epallage fatima* Charpentier.
3. Wings of *Cyanocharis valga* Needham.
4. Wing of *Heterina* sp? (from Brazil).
5. Wing of *Rhinocypha trifasciata*? Selys.
6. Wing of *Archilestes grandis* Rambur.
7. Wing of *Megalestes major* Selys.
8. Wing of *Mecistogaster lucretia* Drury.

PLATE LII.

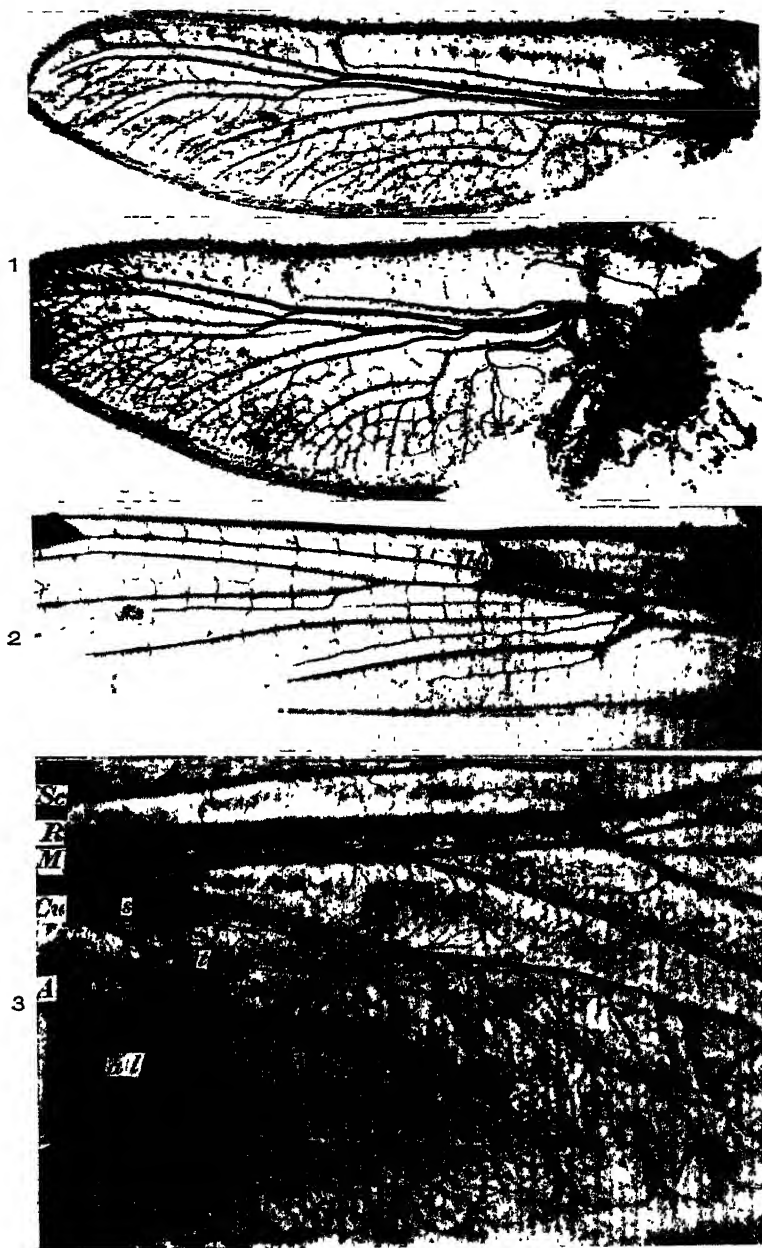
- Fig. 1. Wing of *Micromerus blandus* Selys.
2. Wing of *Libellago caligata* Selys.
3. Wing of *Pseudophæa* sp?
4. Wing of *Epallage fatima* Charpentier.
5. Wing of *Rhinocypha* sp?

PLATE LIII.

- Fig. 1. Wing of *Lestes tricolor* Erichson.
2. Wing of *Palæmna* sp? (from Trinidad).
3. Wing of *Platysticta maculata* Selys.
4. Wing of *Philogenia* sp?
5. Wing of *Argia fumipennis* Burmeister.
6. Wing of *Heteragrion flavovittatum* Selys.
7. Wing of *Agriocnemis pulverulans* Selys.
8. Wing of *Amphipteryx agrioides* Selys.

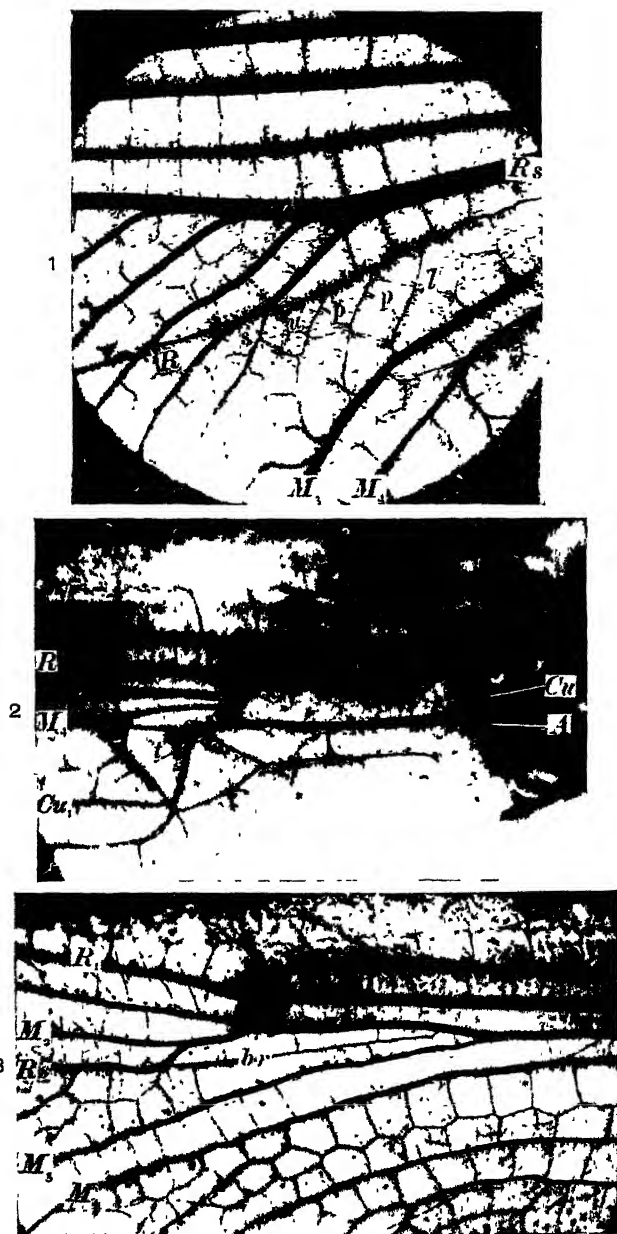
PLATE LIV.

- Fig. 1. Wing of *Tatornemis malgassica* Kirby.
2. Wing of *Disparoneura* sp?
3. Wing of *Idioneura ancilla* Selys.
4. Wing of *Cænoneura curnatice* Selys.
5. Wing of *Hesperagrion heterodoxum* Selys.
6. Wing of *Enallagma annexum* Hagen.
7. Wing of *Erythrargrion saltrum* Hagen.
8. Wing of *Nehalennia irene* Hagen.



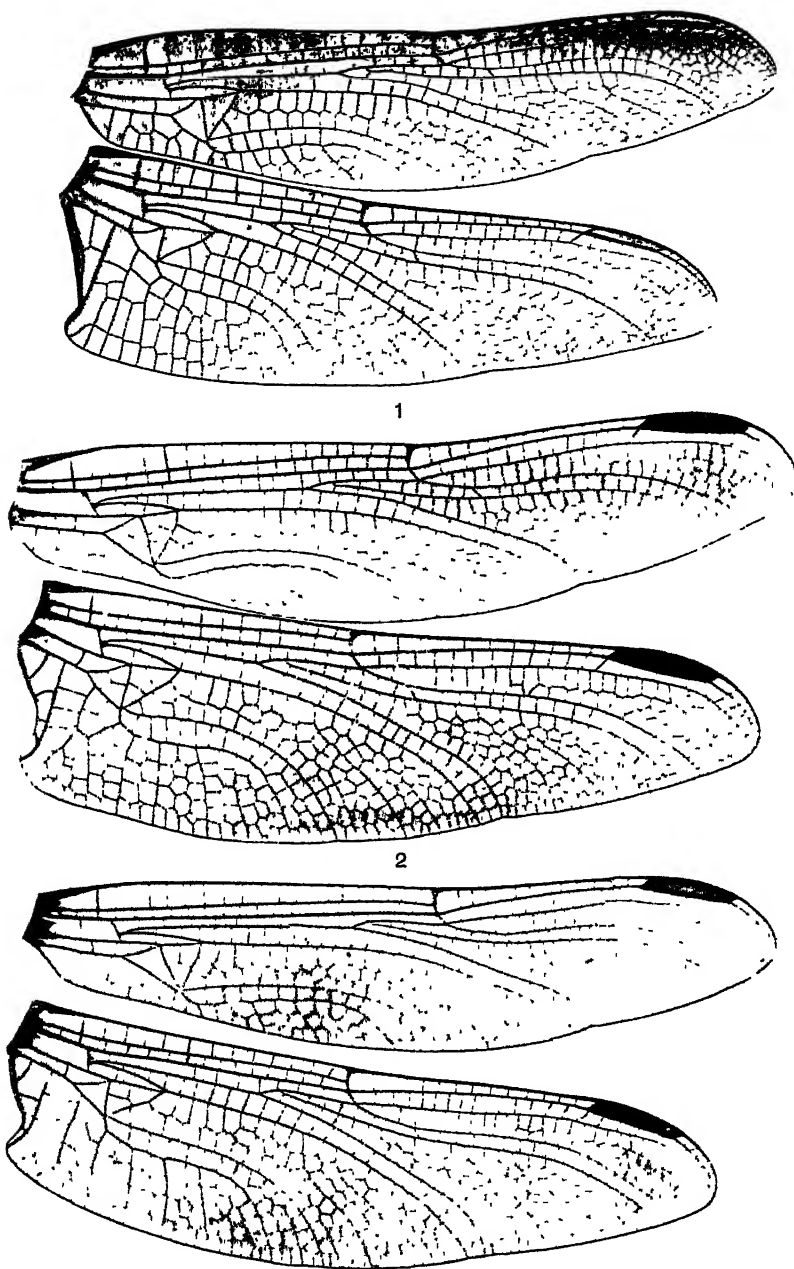
DRAGON-FLY WING VENATION.

FOR EXPLANATION OF PLATE SEE PAGE 762.



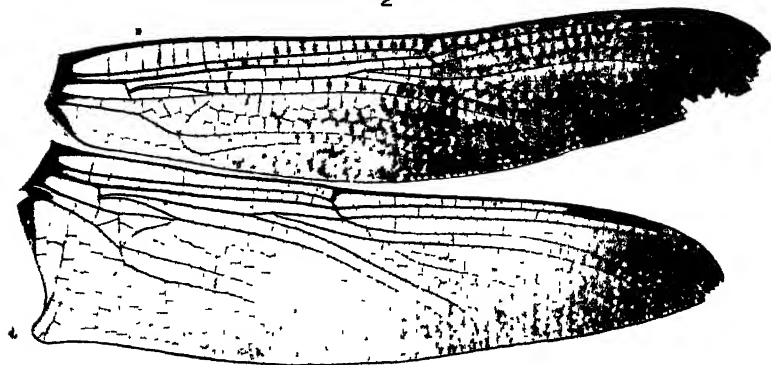
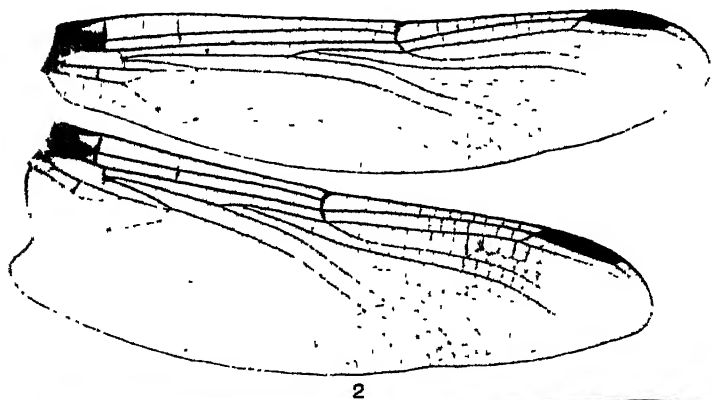
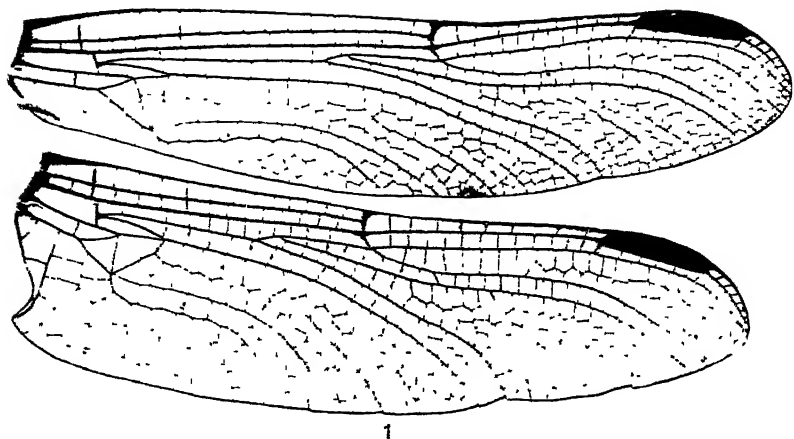
DRAGON-FLY WING VENATION.

FOR EXPLANATION OF PLATE SEE PAGE 762.



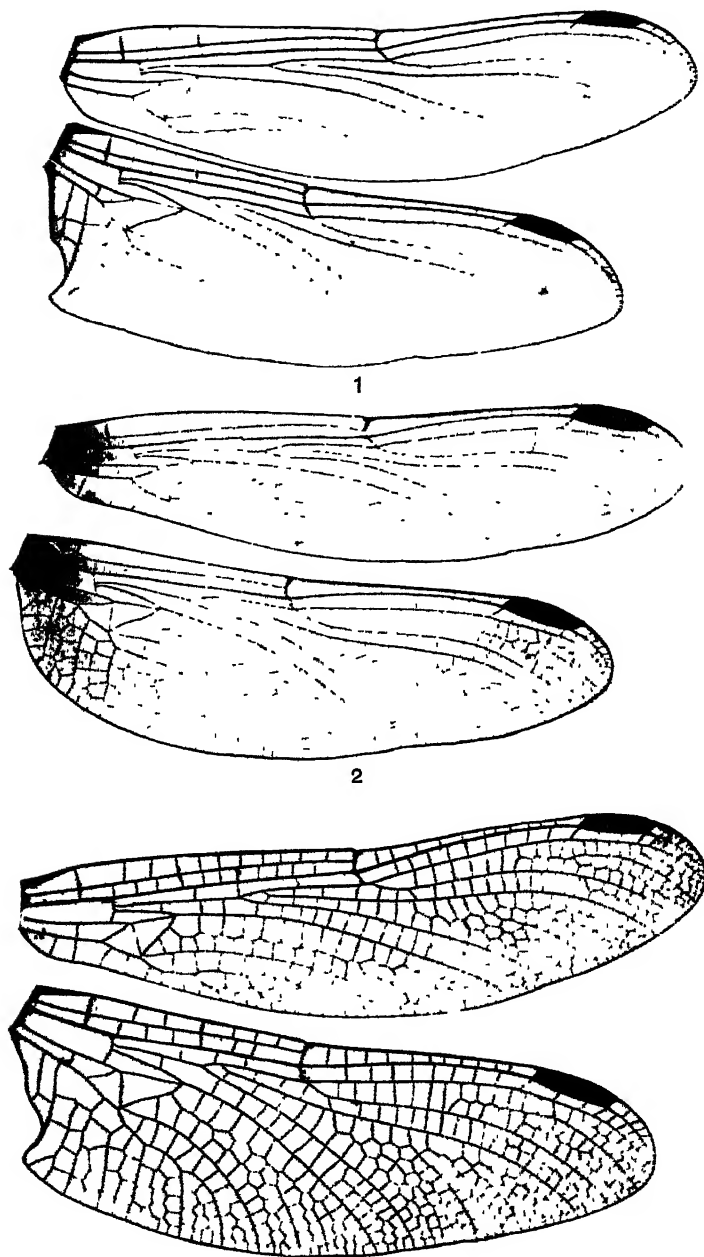
DRAGON-FLY WING VENATION.

FOR EXPLANATION OF PLATE SEE PAGE 762.



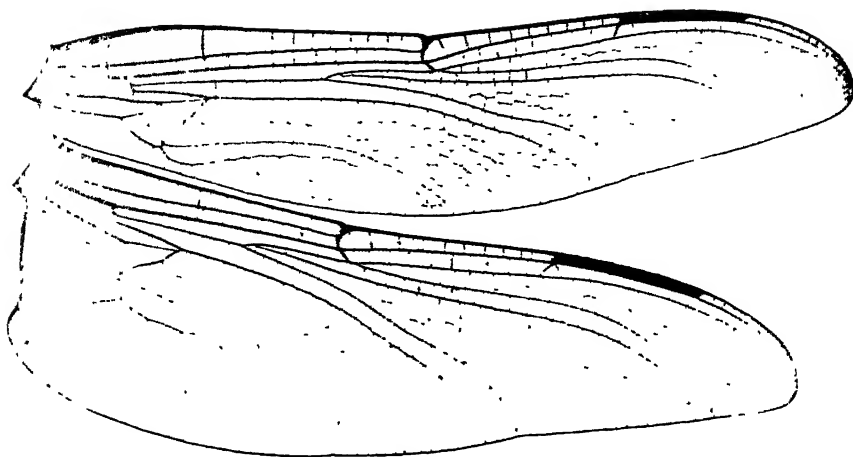
DRAGON-FLY WING VENATION.

FOR EXPLANATION OF PLATE SEE PAGE 762

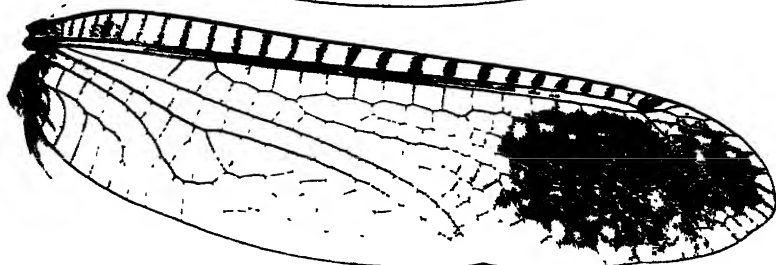
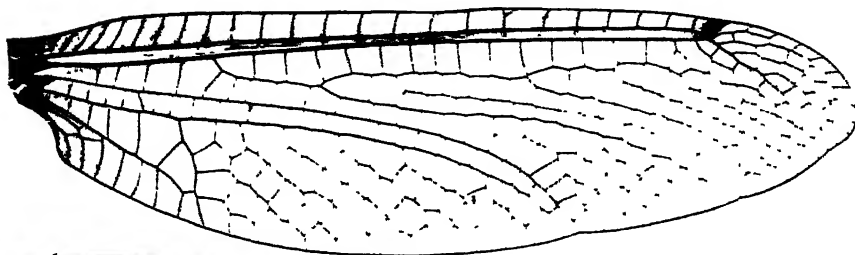


DRAGON-FLY WING VENATION.

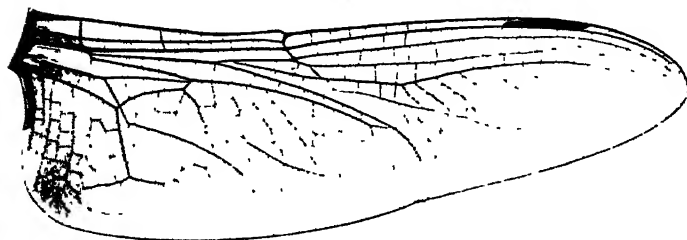
FOR EXPLANATION OF PLATE SEE PAGE 762.



1



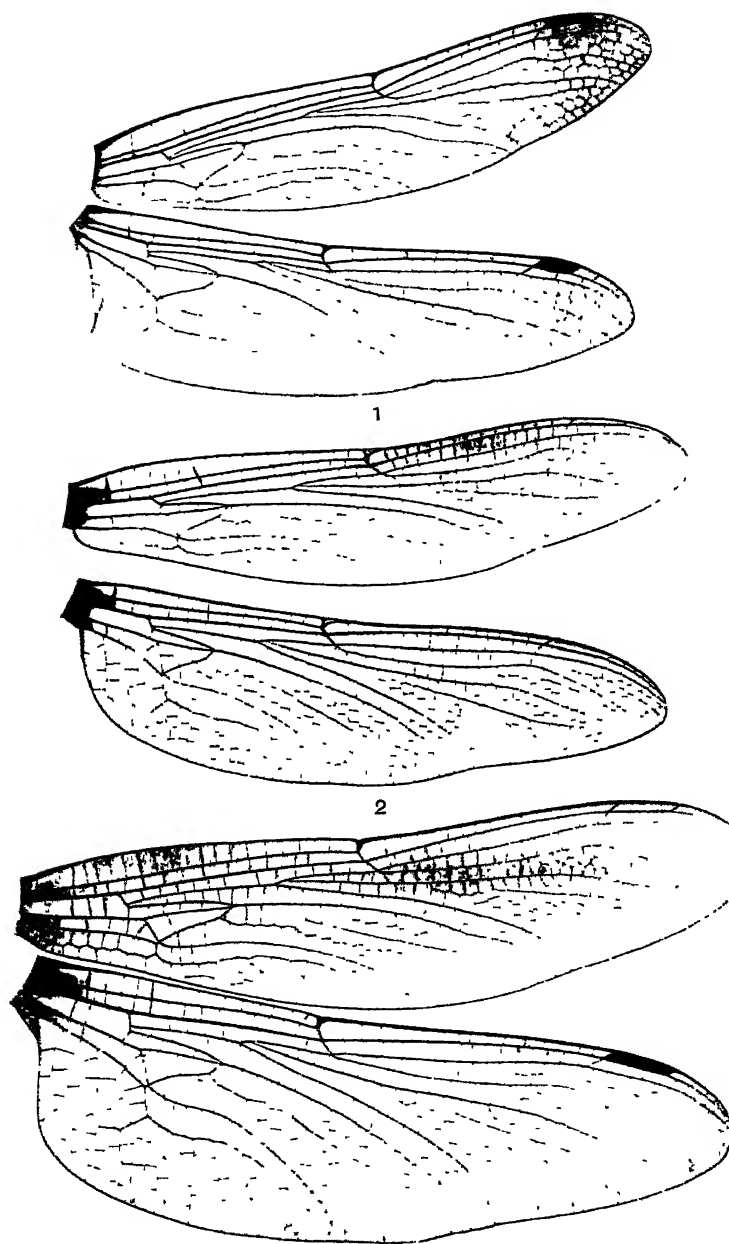
2



3

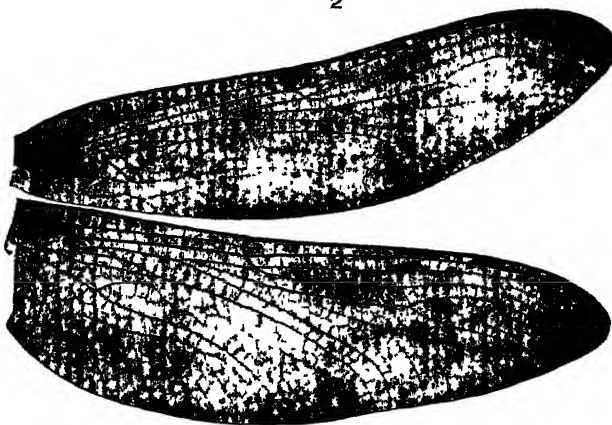
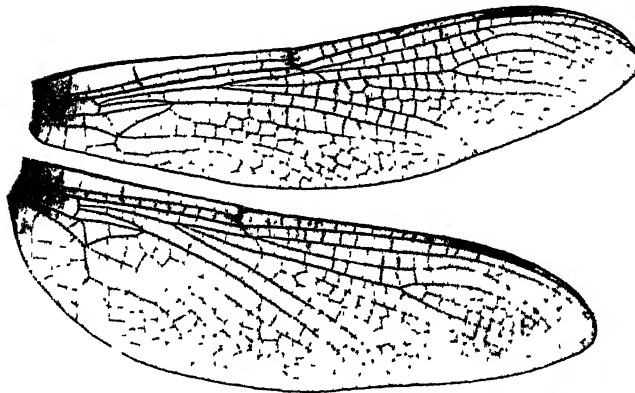
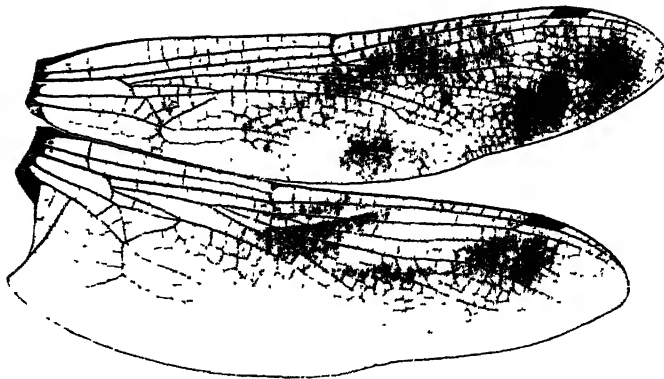
DRAGON-FLY WING VENATION.

FOR EXPLANATION OF PLATE SEE PAGE 762.



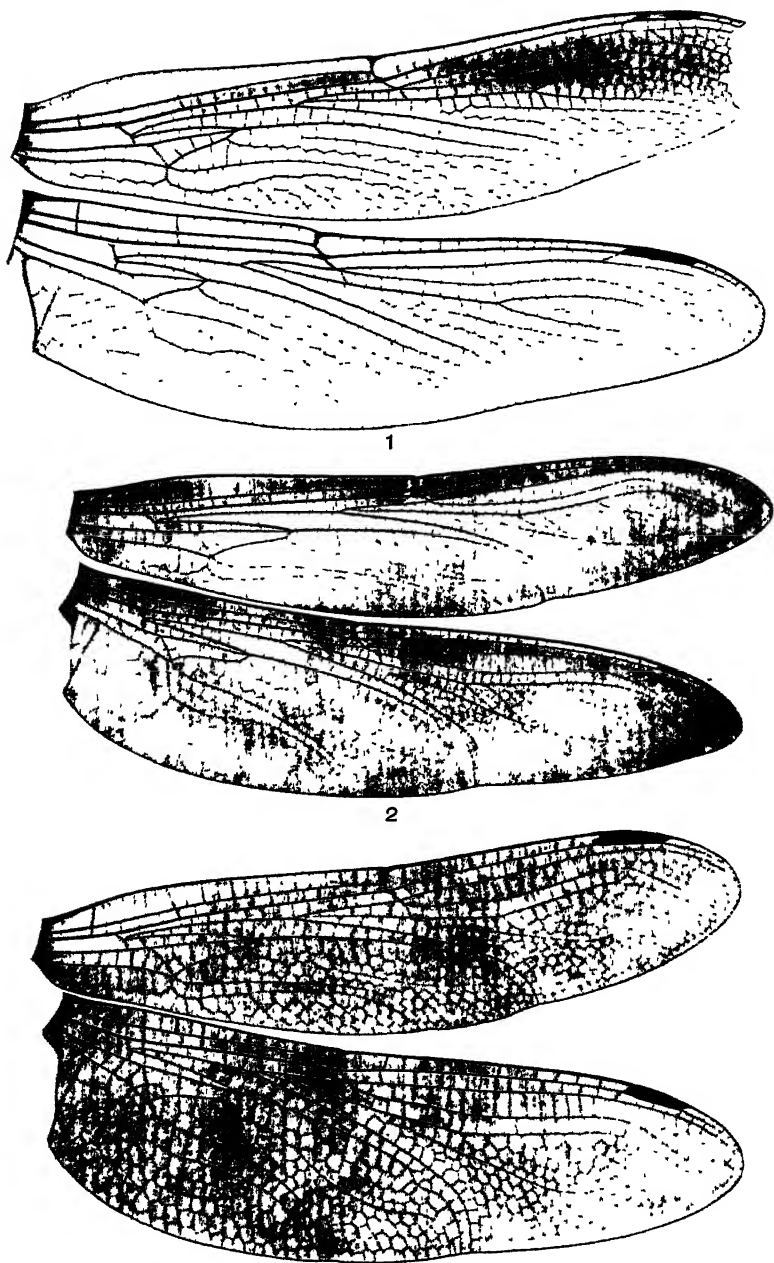
DRAGON-FLY WING VENATION.

FOR EXPLANATION OF PLATE SEE PAGE 762



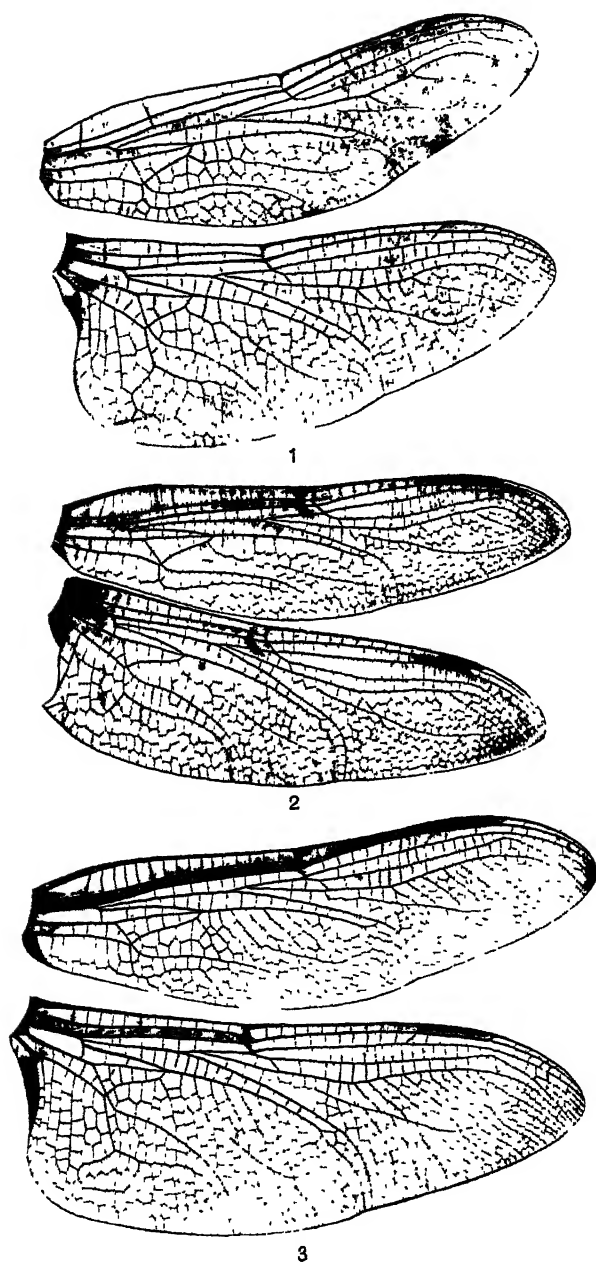
DRAGON-FLY WING VENATION.

FOR EXPLANATION OF PLATE SEE PAGE 762.



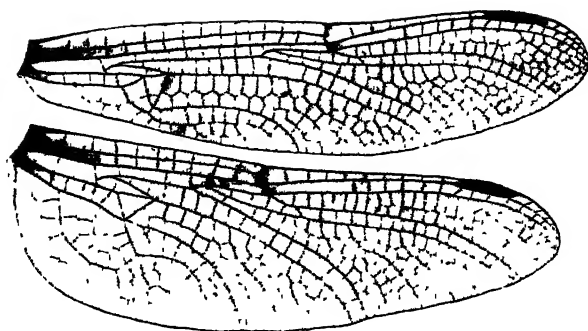
DRAGON-FLY WING VENATION.

FOR EXPLANATION OF PLATE SEE PAGE 762.

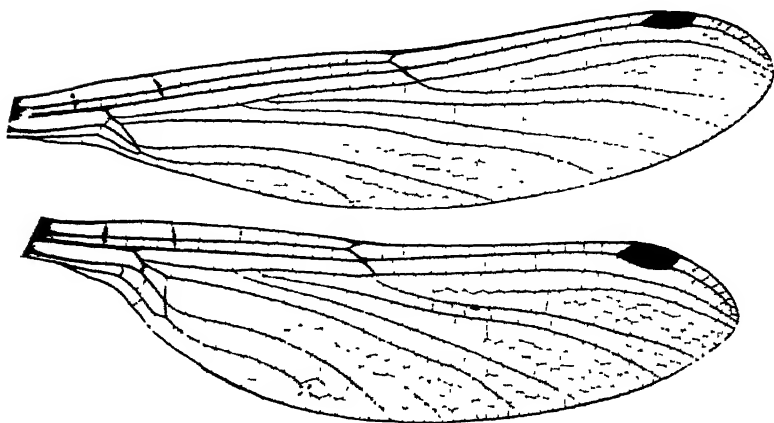
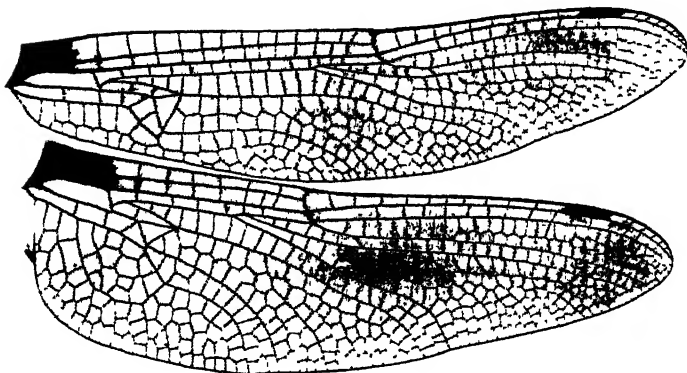


DRAGON-FLY WING VENATION.

FOR EXPLANATION OF PLATE SEE PAGE 763.

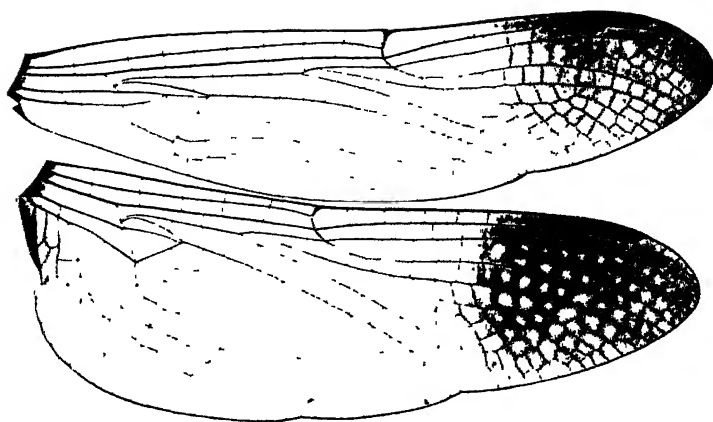


1

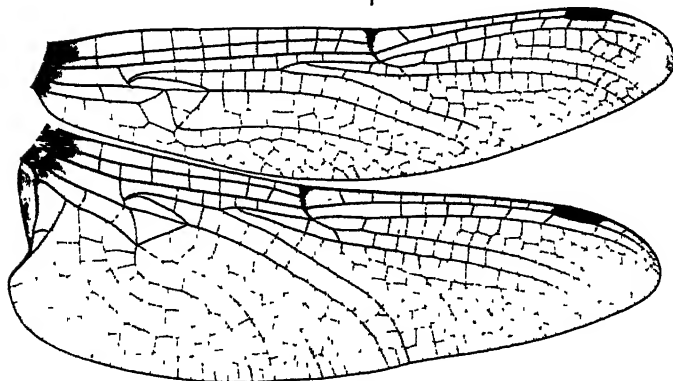


DRAGON-FLY WING VENATION.

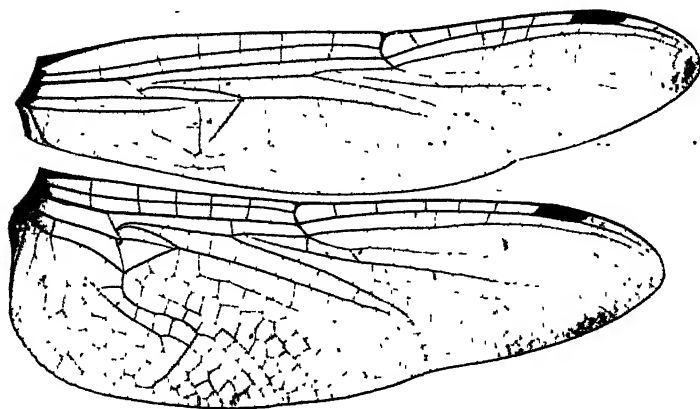
FOR EXPLANATION OF PLATE SEE PAGE 763.



1

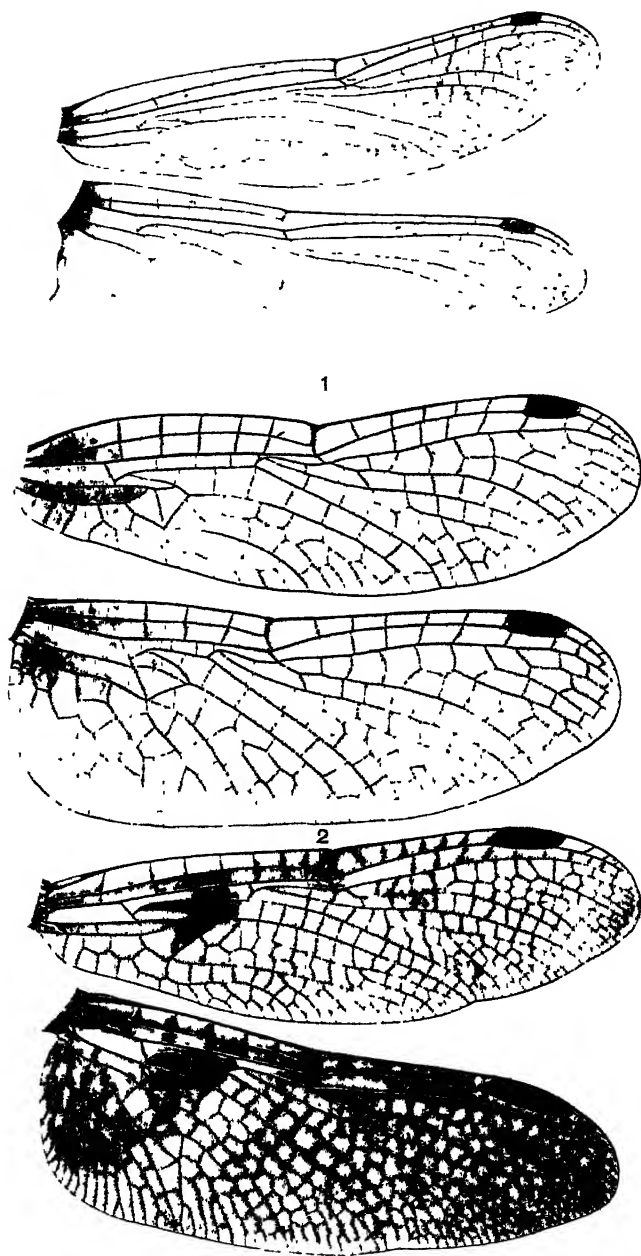


2



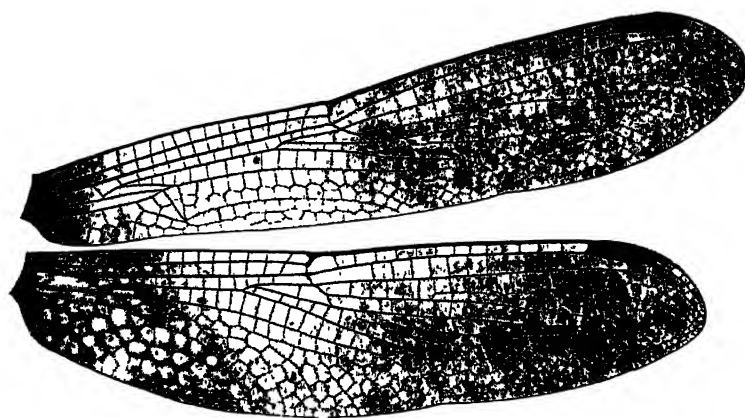
DRAGON-FLY WING VENATION.

FOR EXPLANATION OF PLATE SEE PAGE 763.

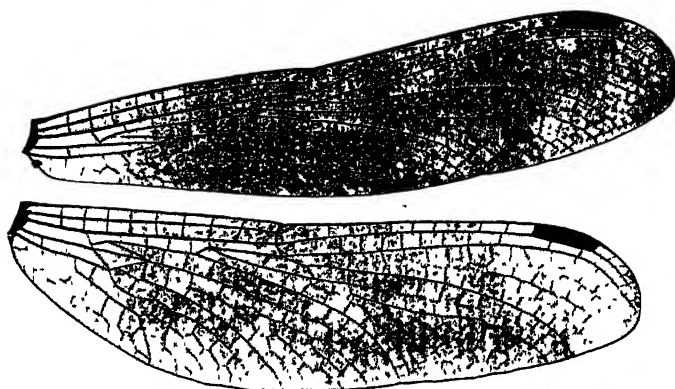


DRAGON-FLY WING VENATION.

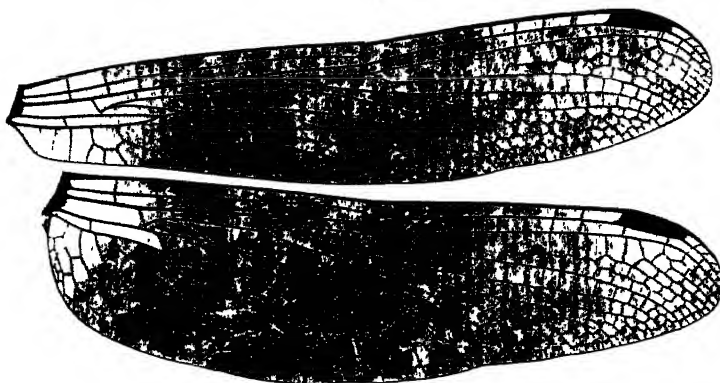
FOR EXPLANATION OF PLATE SEE PAGE 763



1

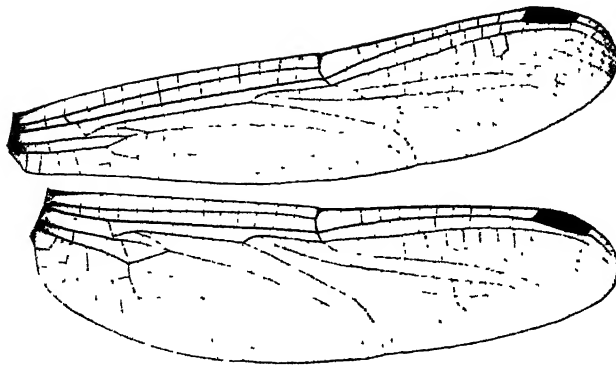


2

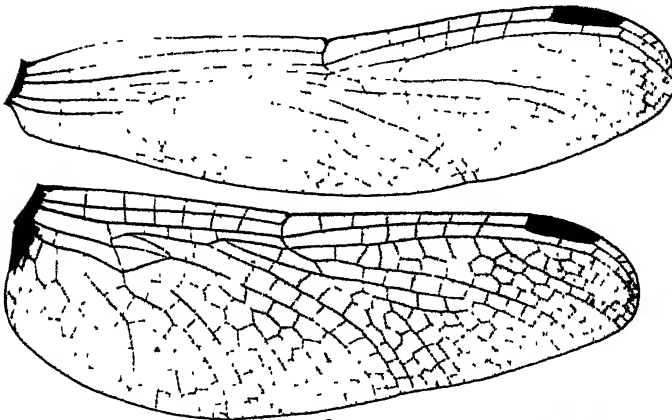


DRAGON-FLY WING VENATION

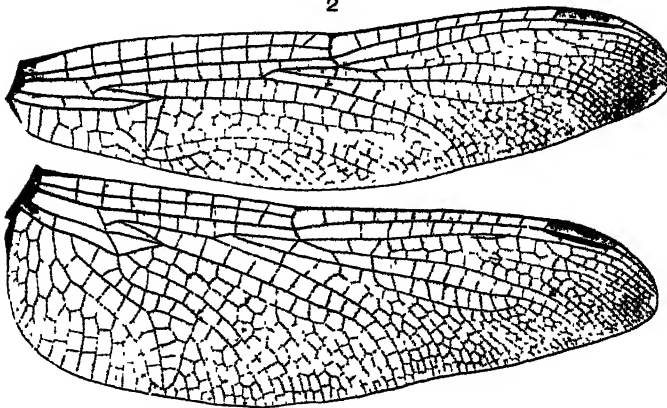
FOR EXPLANATION OF PLATE SEE PAGE 763.



1



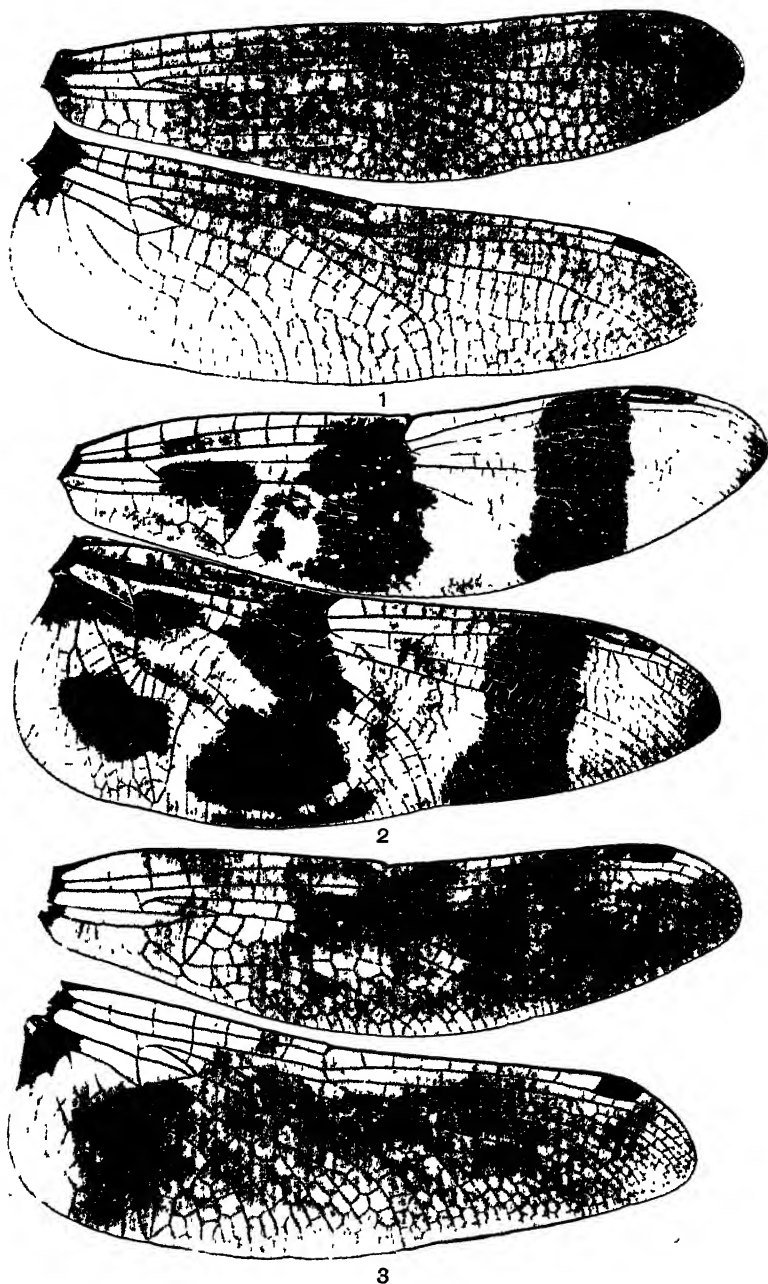
2



3

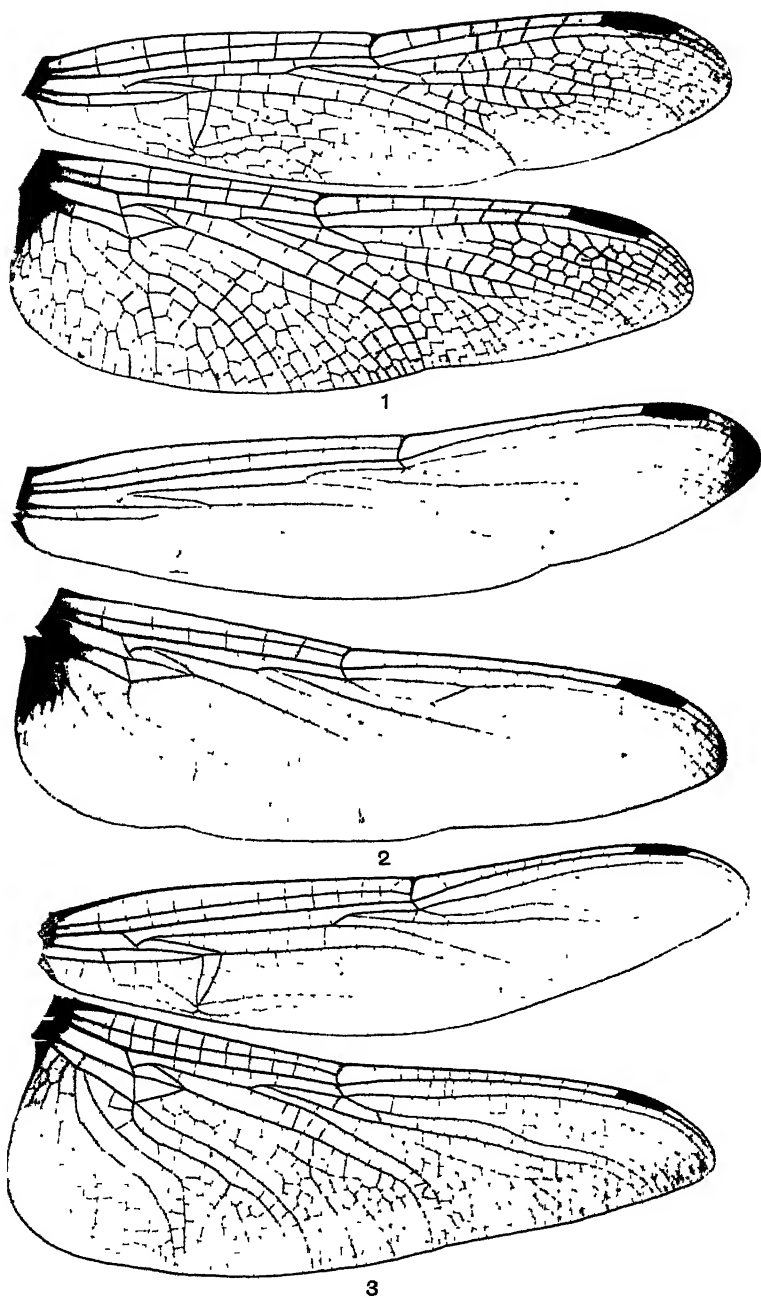
DRAGON-FLY WING VENATION.

FOR EXPLANATION OF PLATE SEE PAGE 763.



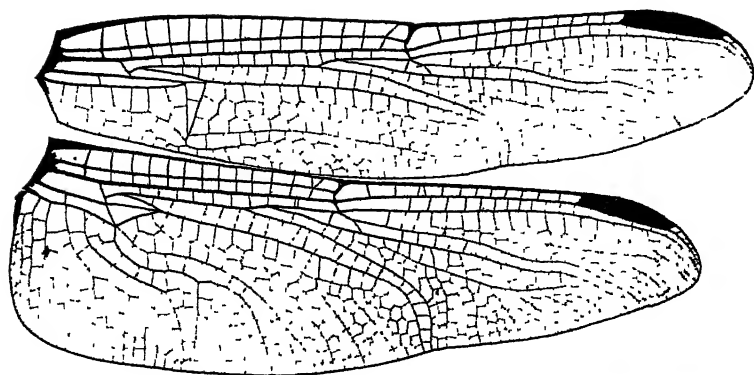
DRAGON-FLY WING VENATION.

FOR EXPLANATION OF PLATE SEE PAGE 763.

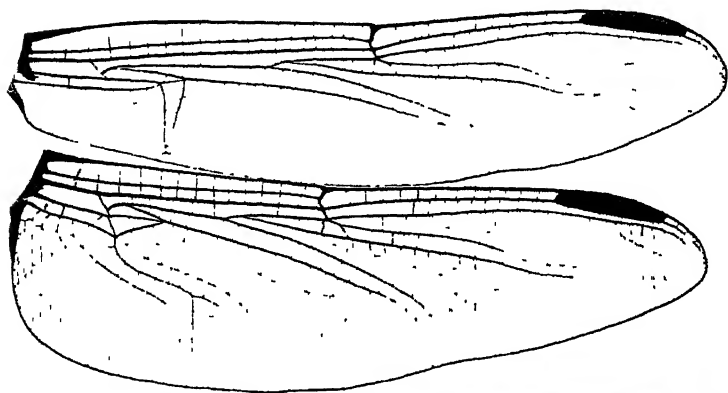


DRAGON-FLY WING VENATION.

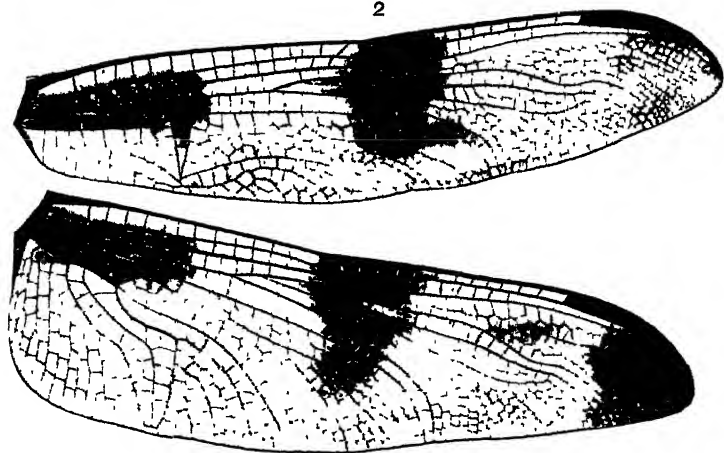
FOR EXPLANATION OF PLATE SEE PAGE 763.



1

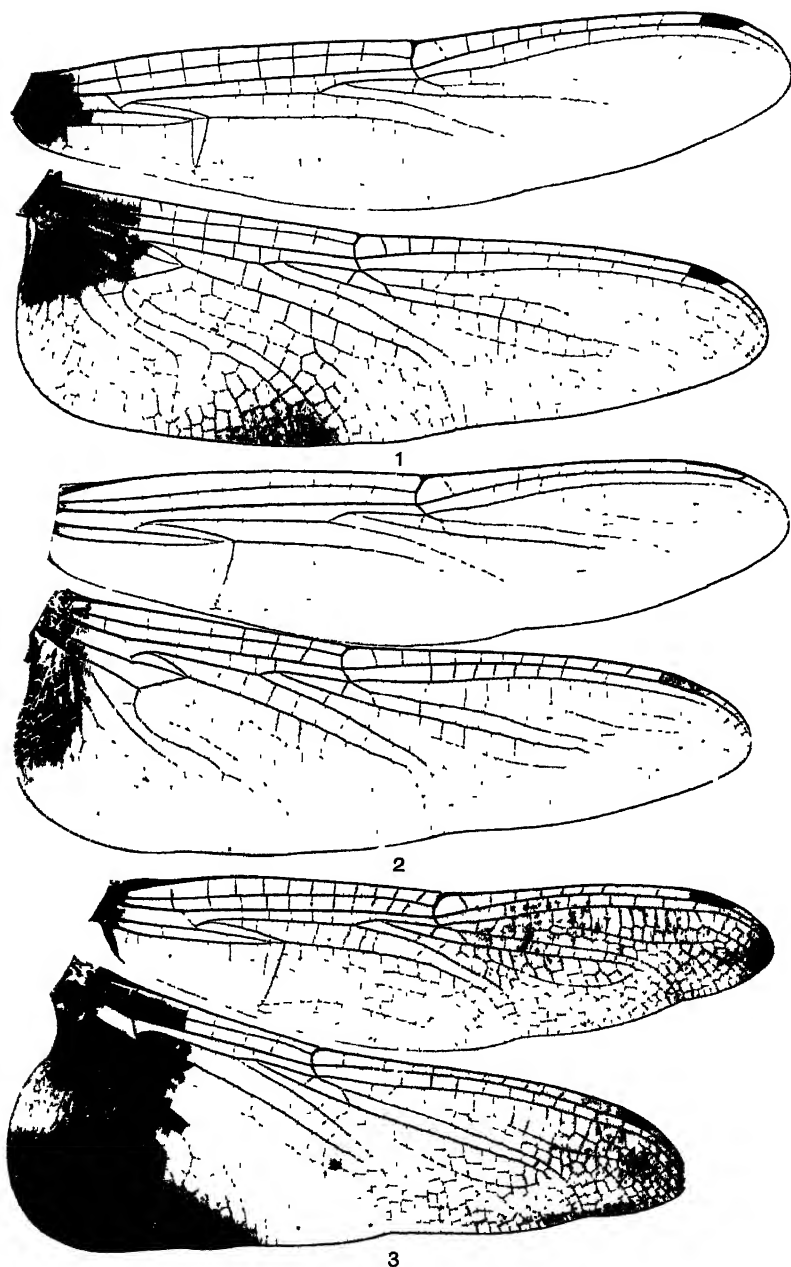


2



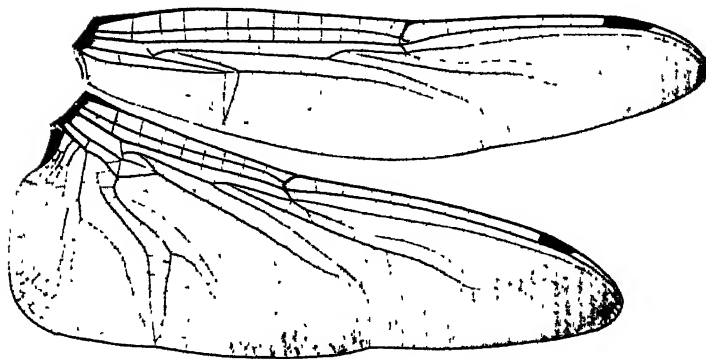
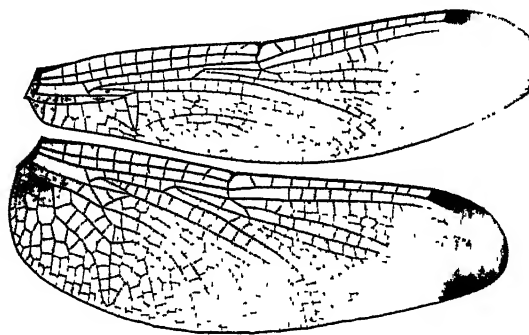
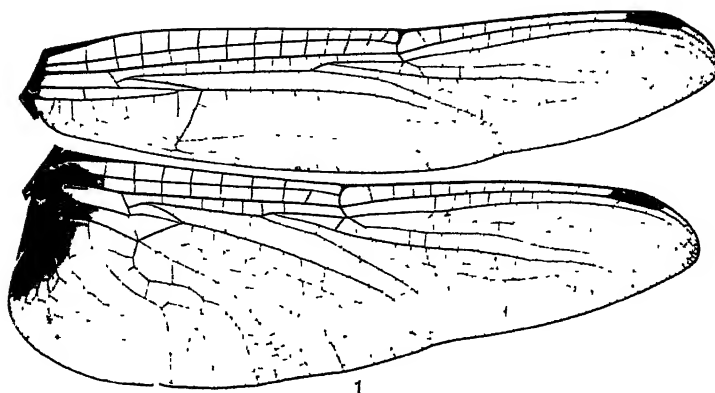
DRAGON-FLY WING VENATION.

FOR EXPLANATION OF PLATE SEE PAGE 763



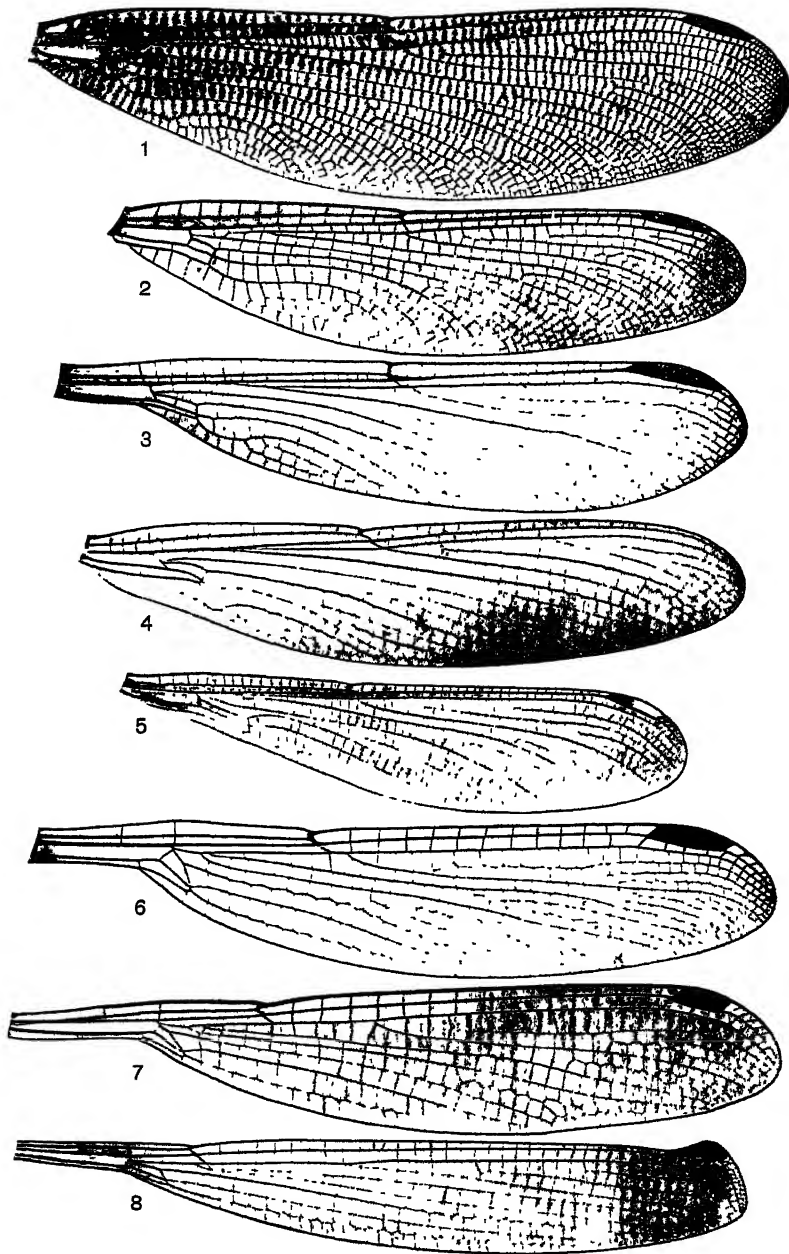
DRAGON-FLY WING VENATION.

FOR EXPLANATION OF PLATE SEE PAGE 763



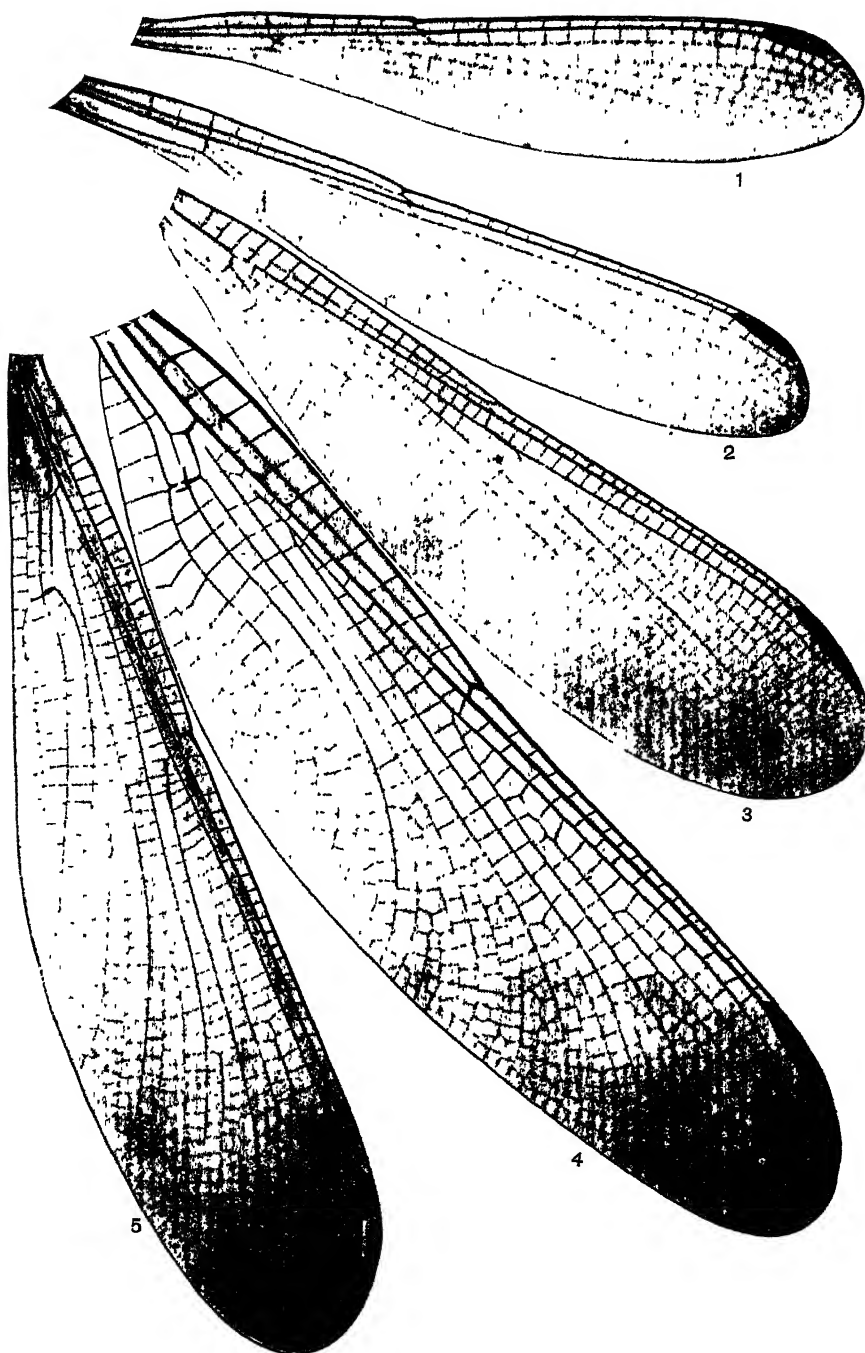
DRAGON-FLY WING VENATION.

FOR EXPLANATION OF PLATE SEE PAGE 764.



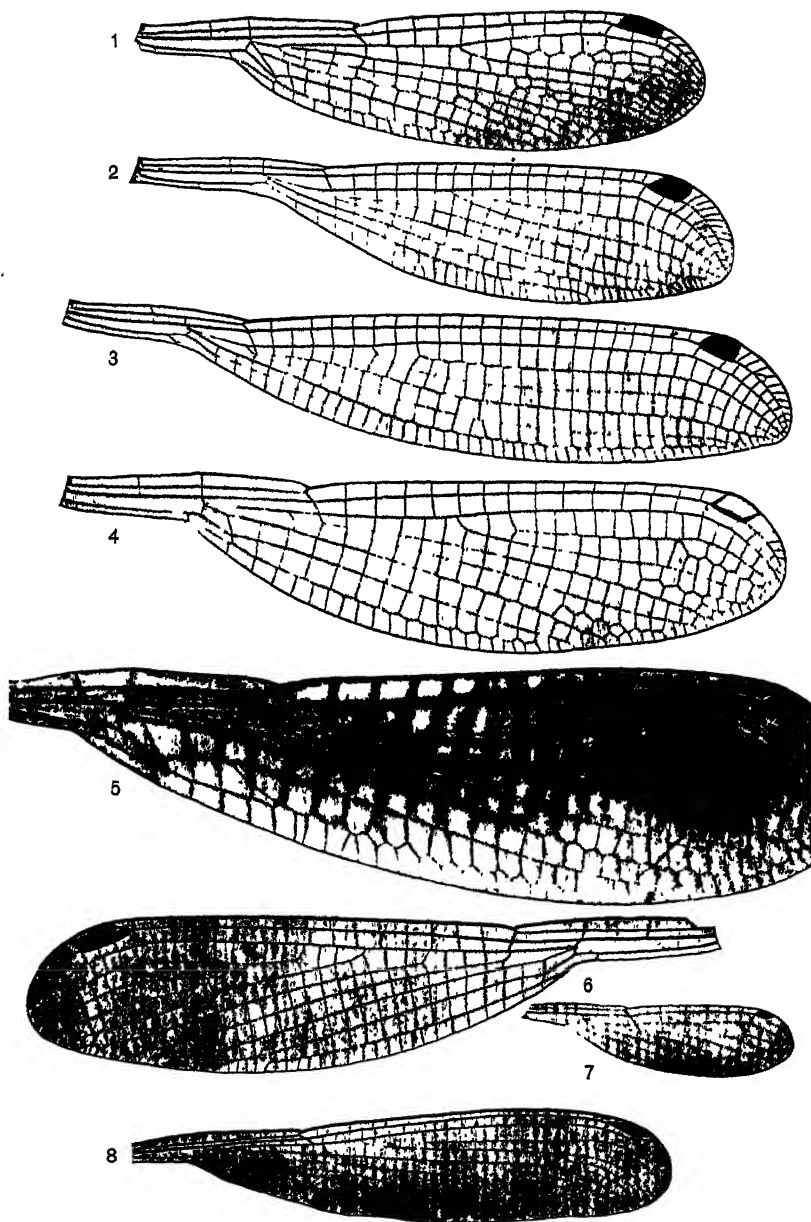
DRAGON-FLY WING VENATION.

FOR EXPLANATION OF PLATE SEE PAGE 764.



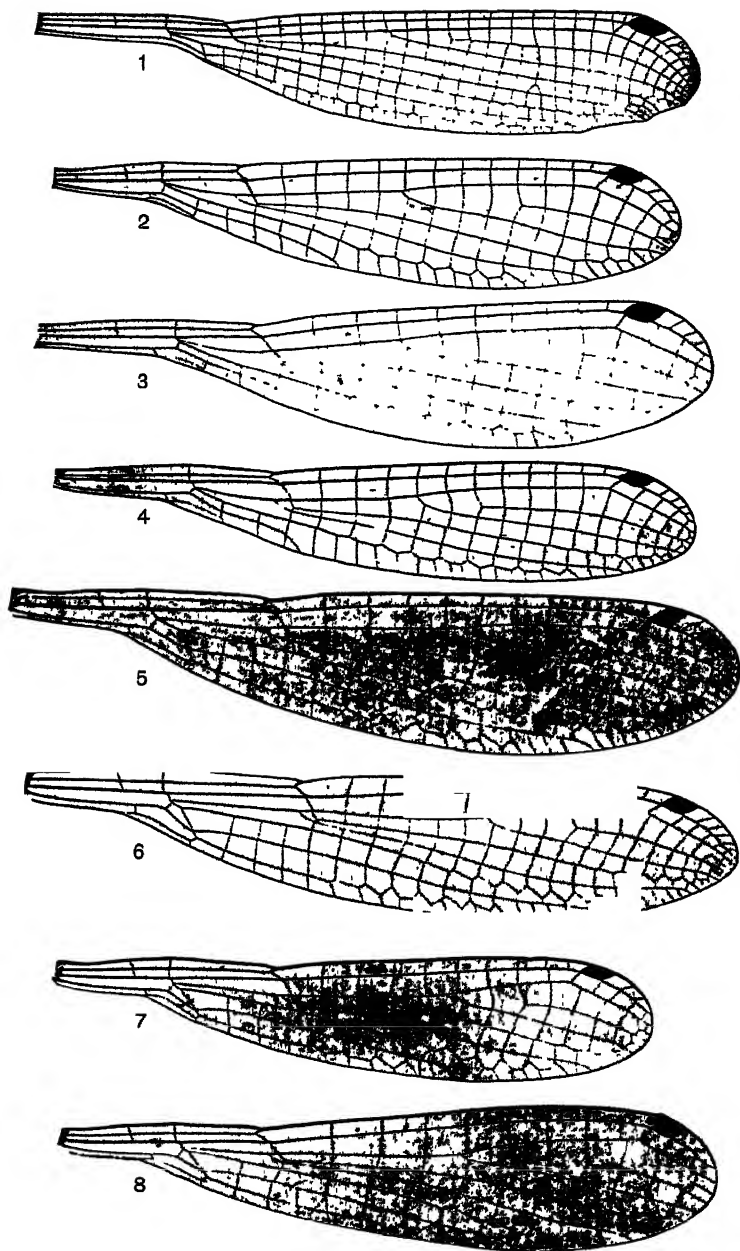
DRAGON-FLY WING VENATION.

FOR EXPLANATION OF PLATE SEE PAGE 764



DRAGON-FLY WING VENATION.

FOR EXPLANATION OF PLATE SEE PAGE 764



DRAGON-FLY WING VENATION.

FOR EXPLANATION OF PLATE SEE PAGE 764.

SMITHSONIAN INSTITUTION.
UNITED STATES NATIONAL MUSEUM.

NOTES ON ORTHOPTERA FROM COLORADO,
NEW MEXICO, ARIZONA. AND TEXAS. WITH
DESCRIPTIONS OF NEW SPECIES.

BY

ANDREW NELSON CAUDELL,
Of the Department of Agriculture.

From the Proceedings of the United States National Museum, Vol. XXVI, pages 775-881
(with Plate LV).

[No. 1333.]



WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1903.

NOTES ON ORTHOPTERA FROM COLORADO, NEW MEXICO, ARIZONA, AND TEXAS, WITH DESCRIPTIONS OF NEW SPECIES.

By ANDREW NELSON CAUDELL,
Of the Department of Agriculture.

The following paper deals with three separate collections: (1) a large collection from Colorado, including a few from just across the line in New Mexico, made by Dr. H. G. Dyar and myself during the months of May, June, July, and August, 1901; (2) a small collection made in Arizona, mostly at Williams and Hot Springs, by Messrs. Schwarz and Barber during the summer of 1901; and (3) a small collection made by the writer in Texas in June and July, 1902. This material forms part of the collection of the U. S. National Museum.

The Colorado collection, which furnishes material for the greater part of this paper, but partially confirms the result reached by Dr. Dyar regarding the life zones of that State as recently described by him—that is, that there are four faunal regions in Colorado: prairie, foothill, alpine, and western slope. The orthopterous fauna indicate the first three zones only, which are in most cases quite sharply defined, but there are a number of species that occur in two or more of the zones. The line between the prairie and the foothill faunas is exceedingly well defined at some places, while at other places the transition from one to the other is more gradual.

The primary aim of the Colorado expedition was to work out the life history of Lepidoptera, and not to collect Orthoptera, and in consequence it was not possible to visit all parts of the State. Therefore the range worked over is not extensive and does not include places inaccessible by rail. A few specimens from Middle Park were purchased from E. J. Osler, a professional collector of Denver, and are included in this paper.

The various localities visited by the writer in Colorado, their altitude, location, and notes on the vicinity are given in the following alphabetical list:

Baileys, Park County; altitude, 7,714 feet.—This place is some miles up the Platte canyon. One day only was spent there and but nine species of Orthoptera were taken.

Boulder, Boulder County; altitude, 5,335 feet.—Two trips were made to this place and a little collecting done in and along the base of the foothills just back of the town. Insects were not at all numerous at the time the visits were made and but five species of Orthoptera were taken.

Chama, Rio Arriba County, New Mexico; altitude, 7,863 feet.—Half an hour only was spent here, six species being taken, of which *Dissosteira carolina* was the most common.

Chimney Gulch.—See Golden.

Cripplecreek, Teller County; altitude, 9,396 feet.—Half a day was spent at this interesting locality out near the Golden King gold mine. *Circotettix undulatus* was the common species.

Cumbres, Conejos County; altitude, 10,015 feet.—One hour of profitable collecting was put in here when it began to rain, and a wet afternoon was utilized in riding down the western slope of the mountains on a freight car rather than wait in a section house for the passenger train next day. Five species only were taken, all alpine forms, one of them a new species.

Delta, Delta County; altitude, 4,980 feet.—Several hours were spent across the river from this place, mostly in investigating garden insects. Two species of *Eoloplus* were taken. At this place some damage was threatened by *Melanoplus differentialis*.

Denver, Arapahoe County; altitude, 5,193 feet.—Most of the collecting in the vicinity of Denver was done in two localities, one south of the city, on the prairie just beyond the city park, and the other on the opposite side of the city. Nearly forty species and many specimens were taken here.

Durango, La Plata County; altitude, 6,530 feet.—A few hours were spent collecting north and east of this town. The limited time prevented the discovery of the excellent collecting grounds said by Mr. Osler to exist in that vicinity.

Fort Collins, Larimer County; altitude, 4,973 feet.—Two visits were made to this productive locality and many desirable specimens taken, mostly north and west of town. No opportunity presented itself to go up into the neighboring foothills, and the specimens taken were therefore all prairie forms, or ones common to two or more faunal regions. One species only, *Eremopedes halli*, may be considered as belonging strictly to the foothill fauna. Forty-eight species were taken at this place.

Glenwood Springs, Garfield County; altitude, 5,758 feet.—Three stops were made at this place, but little collecting was done. A few specimens were taken out east of town a half mile or so and also a few in town near the station. But seven species were taken, of which four belong to the genus *Melanoplus*.

Golden, Jefferson County; altitude, 5,667 feet.—This is a good collecting ground and very accessible from Denver, being about 13 miles

west of there near the foothills. The collecting was done on the prairie between the town and the foothills, less than a quarter of a mile in width, and up the canyon known as Chimney Gulch to the top, about a thousand feet higher. Over fifty species were collected at this locality. The prairie and foothill faunas are here quite distinctly and abruptly divided.

Grand Junction, Mesa County; altitude, 4,594 feet.—Two stops of short duration were made here. The collecting was done northeast of town and also in town just across the railroad from the station, where many fine specimens of *Melanoplus differentialis* were taken.

Mancos, Montezuma County; altitude, 7,008 feet.—Two species were taken near the station while the train stopped, *Melanoplus femur rubrum* and *Stenobothrus curticaudis*.

Monterista, Rio Grande County; altitude, 7,665 feet.—A bicycle trip several miles out of town was taken August 13. Insect life of all kinds was very scarce and but nine species of Orthoptera were taken, the most desirable one of which was probably *Nimobius utahensis*.

Montrose, Montrose County; altitude, 5,811 feet.—Half an hour's collecting in the vicinity of the station resulted in the capture of nearly a dozen species.

Morrison, Jefferson County; altitude, 5,753 feet.—Several visits were made here. Just south of the station, across the creek beyond and to the right of the schoolhouse, grasshoppers were found to abound in countless numbers. Collecting trips were made to and beyond the picturesque red sandstone formations northwest of town and up the canyon into the foothills. But two species were collected in the foothills, however, *Trimacrotropis similis* and *Gomphocerinus claratus*. The bulk of the specimens taken on the prairie at this place was *Melanoplus occidentalis*.

Palisade, Mesa County; altitude, 4,341 feet.—At this little town, 12 miles from Grand Junction, *Eoloplus chunopodii* was taken in considerable numbers on the plants just across the railroad from the station. A few other species, including a new species, were taken in the immediate vicinity.

Pikes Peak, El Paso County; altitude, 8,913 feet.—A day was spent here and the ascent of the peak made.^a The above altitude is that of the halfway house, and it is to that locality which all the Pikes Peak labels refer unless otherwise specified.

Pine Grove, Park County; altitude, 6,738 feet.—This is a small resort some miles up Platte Canyon, and there a couple of days were spent collecting along the railroad and up a side canyon for a mile or so, leading up probably a thousand feet above the town. A dozen species were taken here, mostly true foothill forms.

Platte Canyon, Douglas County; altitude, 5,493 feet.—Numerous trips were made to this place, which is but a station at the mouth of

^a See account in Proc. Ent. Soc. Wash., V, 1902, pp. 74-82.

Platte Canyon. Collecting was done up the canyon as far as a small side gulch known as Mill Gulch, and up that gulch for more than a mile, as well as up other gulches for lesser distances. But most of the Orthoptera were taken near the mouth of the canyon. But ten species were taken here.

Rico, Dolores County; altitude, 8,737 feet.—Insects were very scarce here, two hours' collecting resulting in but three species of Orthoptera and practically nothing else. The Orthoptera were all alpine forms.

Salida, Chaffee County; altitude, 7,050 feet.—Two weeks were spent here, including a couple of visits. Other duties prevented much time being devoted to collecting Orthoptera, and nearly every afternoon it rained, but still quite a number of good things were taken. By far the most productive locality was the side of the large hill, called Tenderfoot Mountain, just across the railroad from the station. Here *Eoloplus plugosus* and *Derotmemus haydeni* occurred in numbers. *Leprus cyaneus* was also taken here, though not so numerous and usually some distance farther up the hill.

Sedalia, Douglas County; altitude, 5,835 feet.—This small town is a few miles south of Denver, and is in a broad valley formed by the foothills on the west and high mesas on the east. Collecting was done across the entire valley, but only eleven species were taken.

At the above localities over a hundred species of Orthoptera were taken and the collections from Arizona and Texas bring the number up to one hundred and fifty-four. All are here mentioned, even if only for the value attached to record of exact locality, but many of the species are represented by a considerable number of specimens and thus usually furnish some notes of value on variation or distribution.

Family BLATTIDÆ.

1. PHYLLODROMIA GERMANICA Linnæus.

Blatta germanica LINNÆUS, Syst. Nat., 12th ed., II, 1767, p. 688.

One nymph of this species was taken at Glenwood Springs on August 18.

2. BLATTA ORIENTALIS Linnæus.

Blatta orientalis LINNÆUS, Syst. Nat., 10th ed., I, 1758, p. 424.

Two specimens, both males, one at Denver and one at Pueblo in August, the latter by E. J. Osler.

3. ISCHNOPTERA UHLERIANA Saussure.

Ischnoptera uhleriana SAUSSURE, Rev. Mag. Zool., XIV, 1862, p. 169.

One specimen at Victoria, Texas, in June.

4. PERIPLANETA AMERICANA Linnaeus.

Blatta americana LINNÆUS, Syst. Nat., 10th ed., I, 1758, p. 424.

This insect is very common in southern Texas, indeed amounting to a veritable pest. It comes into the houses through the open windows and but for the ever-present canopy of netting over the beds in that part of the country would very probably establish itself as an unwelcome and very uncomfortable spiny bedfellow. Happily the netting prevents this, but unhappily the *Acantha lectularia* is not so easily excluded.

A razor case left for a couple of weeks in a drawer in one of Victoria's leading hotels, had the covering nearly all eaten off by this large roach. The ordinary house species, *Phyllotromia germanica* and *Blatta orientalis*, do not appear to be common in localities where this species thrives.

5. PERIPLANETA TRUNCATA Krauss.

Periplaneta truncata KRAUSS, Zool. Anzeiger, XV, 1892, p. 165.—SAUSSURE and ZEHNTNER, Biol. Cent. Amer. Orth., I, 1893, p. 74.

Two female specimens of this species were collected in the laboratory of the boll weevil investigation at Victoria, Texas, in the early part of July, 1902. This is a new insect to the United States, but there can be but little doubt of the correctness of the identification. It is the variety "a" of Saussure and Zehntner.

6. HOMŒOGAMIA APACHA Saussure.

Homœogamia apacha SAUSSURE, Rev. Suisse de Zool., I, 1893, p. 396.

The collection of the U. S. National Museum contains specimens of this species from Texas, Colorado, Arizona, and California. This is the first record of this species from the United States, though it seems to be not at all rare. *Homœogamia subdiaphana* Scudder seems somewhat allied to this species, but Mr. Rehn, who has taken *subdiaphana* in New Mexico, says they are distinct.

Family MANTIDÆ.

7. YERSINIA SOLITARIA Scudder.

Yersinia solitaria SCUDDER, Can. Ent., XXVIII, 1896, p. 209.

Two immature specimens of this species were taken, one at Fort Collins and one at Golden, the former on August 9 and the latter on July 17.

8. LITANEUTRIA MINOR Scudder.

Stagmatoptera minor SCUDDER, Rept. U. S. Geol. Surv. Nebr., 1871, p. 251.

Females of what I take for this species were taken at Golden and Fort Collins in August. The greedy habits of this species were recently noted."

Family PHASMIDÆ.

9. DIAPHEROMERA DENTRICUS Stål.

Diapheromera dentricus STÅL, Rec. Orth., III, 1875, p. 76.

One male, June 21, at Victoria, Texas. This specimen was on weeds by the roadside. Mr. Mitchell tells me that this fine large walking stick is not uncommon at times on grape vines in the river bottoms.

Family ACRIDIIDÆ.

Subfamily TETTIGIDINÆ.

10. TETRIX CRASSUS Morse.

Tetrix crassus MORSE, Journ. N. Y. Ent. Soc., VII, 1890, p. 201.

Two specimens of what Professor Morse thinks is probably this species were taken at Platte Canyon on May 10. The median carina of the thorax is marked with white, strongly contrasted with the rest of the insect.

11. TETRIX INCURVATUS Hancock.

Tetrix incurvatus HANCOCK, Amer. Nat., XXIX, 1895, pp. 761-762, fig. 1.

Five specimens, Platte Canyon May 10, in company with *T. crassus*. Dr. Hancock verified this determination.

12. PARATETRIX CUCULLATUS Burmeister.

Tetrix cucullatus BURMEISTER, Handb. Ent., II, 1838, pp. 658-659.

One female at Fort Collins August 11. Professor Morse examined this specimen and pronounced the determination correct.

Subfamily TRYXALINÆ.

13. MERMIRIA TEXANA Bruner.

Mermiria texana BRUNER, Proc. U. S. Nat. Mus., XII, 1890, pp. 53-54, pl. 1, fig. 11.

One pair at Fort Collins on August 9, and one male nymph, which is probably of this species, at Salida on August 2.

14. *SYRBULA ADMIRABILIS* Uhler.

Stenobothrus admirabilis UHLER, Proc. Ent. Soc. Philad., II, 1864, p. 553.

Both mature and immature specimens of both sexes taken at Victoria in June and July.

15. *ACROLOPHITUS HIRTIPTES* Say.

Gryllus hirtipes SAY, Amer. Ent., III, 1828, p. 78, pl. xxvix.

The "green fool," as Dr. Dyar and I christened this handsome insect, is very common along the eastern foothills, more than a hundred being taken, mostly at Golden. Young nymphs were taken early in May, and mature individuals began to appear about the middle of July.

16. *ERITETTIX NAVICULA* Scudder.

Gomphocerus navicula SCUDDER, Ann. Rept. Chief Eng., 1876, p. 506.

Three males, seven females, Sedalia June 12; Denver May 7; Boulder May 27; Golden June 5. One of the females taken at Golden on June 5 is placed here with some hesitation. It is remarkable in having the pronotum uniformly fuscous dorsally and without a trace of supplementary carinae on the pronotum, though they are present on the head and diverge anteriorly to meet the raised margins of the vertex. The upper half of the lateral lobes of the pronotum is piceous, a coloration unlike any other specimen of any species of this genus that I have seen. The original description of *navicula* offers no distinguishing features to separate it from *E. tricarinatus*, which was described from the female sex alone. In fact, the females of the two species, as I have them determined in the collection of the U. S. National Museum, are inseparable, but the males are very readily distinguished, those of *navicula* having the antennae gradually enlarged, the club composing about one-third of the entire length, while in *tricarinatus* the enlargement of the antennae is abrupt, the club composing no more than one-sixth of the entire length. The Museum contains specimens of *navicula* from Wyoming and Colorado in considerable numbers. *Tricarinatus* does not appear to occur in Colorado, all the Museum material being from Wyoming, Montana, and the Dakotas.

17. *AMPHITORNUS BICOLOR* Thomas.

Stenobothrus bicolor THOMAS, Ann. Rept. U. S. Geol. Surv. Terr., V, 1872, p. 465.

Three males, eight females, Golden June 6 to 27; Fort Collins August 9 and 11; Denver July 7 and 16.

18. *OPEIA OBSCURA* Thomas.

Oryzoryphus obscura THOMAS, Ann. Rept. U. S. Geol. Surv. Terr., V, 1871, p. 466.

One male, eleven females, Golden August 21; Fort Collins August 10.

19. CORDILLACRIS CINEREA Bruner.

Ochrilideu cinerea BRUNER, Proc. U. S. Nat. Mus., XII, 1890, pp. 52-53.

Three males, one female, Salida August 21; Morrison June 25.

20. CORDILLACRIS CRENULATA Bruner.

Ochrilidea crenulata BRUNER, Proc. U. S. Nat. Mus., XII, 1890, pp. 51-52.

Five males, two females, Montevista August 13; Morrison June 29; Denver July 16.

21. CORDILLACRIS OCCIPITALIS Thomas.

Stenobothrus occipitalis THOMAS, Rept. U. S. Geol. Surv. Terr., V, 1873, p. 81.

Fourteen males, eleven females, Morrison June 23; Fort Collins August 9 and 11; Denver July 17.

22. PHLIBOSTROMA QUADRIMACULATUM Thomas.

Stenobothrus quadrimaculatum THOMAS, Ann. Rept. U. S. Geol. Surv. Terr., II, 1871, pp. 166, 280.

Thirty-seven males, forty-four females, Golden July 12 to August 21.

23. ORPHULELLA PELIDNA Burmeister.

Gomphocerus pelidna BURMEISTER, Handb. Ent., II, 1838, p. 650.

One male at Victoria, Texas, in June, 1902, and two males from widely separated localities in Colorado, one from Grand Junction on August 17 and one from Fort Collins on August 10. The specimen from Texas is a little over the usual size, measuring as follows: Length of body, 20.5 mm.; elytra, 18 mm.; hind femora, 12 mm.

The larger males of this species superficially resemble the dark form of the males of *Syrbula admirabilis* very closely.

24. ORPHULELLA PICTURATA Scudder.

Orphulella picturata SCUDDER, Can. Ent., XXXI, 1899, pp. 178, 182.

Many specimens of both sexes collected at Victoria, Texas, in June and July, some of them taken in cotton fields. This is a very variable species and there are both green and brown forms.

25. ORPHULELLA SALINA Scudder.

Orphulella salina SCUDDER, Can. Ent., XXXI, 1899, pp. 179, 185-186.

Two specimens from Colorado, one male at Montrose on August 17, and one female at Grand Junction on July 7.

26. *DICHROMORPHA VIRIDIS* Scudder.

Chloealtis viridis SCUDDER, Bost. Journ. Nat. Hist., VII, 1862, p. 455.

Chloealtis brunnea SCUDDER, Proc. Bost. Soc. Nat. Hist., XVII, 1875, p. 510.

Both sexes of this species, together with the nymphs, were found plentiful at Victoria, Texas, in June and July. This species varies in the character of the lateral carinæ of the pronotum, some having the carinæ parallel and others quite noticeably bowed out in the center, both forms occurring together. One specimen before me from Florida has the vertex abnormally acute. I have carefully studied the type of *brunnea* in the Museum collection and compared it with brown forms of *viridis* and find no appreciable difference not covered by variation. I have therefore included it as a synonym.

27. *STENOBOTHRUS CURTIPENNIS* Harris.

Locusta curtipennis HARRIS, Cat. Ins. Mass., 1835, p. 56.

One female at Montevista on August 13, one at Mancos on August 16, and one male and two female specimens from Cumbres on August 14. The females from Cumbres have the elytra very short, but little more than half as long as the abdomen.

28. *GOMPHOCERUS CLAVATUS* Thomas.

Gomphocerus clavatus THOMAS, Rept. U. S. Geol. Surv. Terr., V, 1873, p. 96.

Gomphocerus carpenterii THOMAS, Bull. U. S. Geol. Surv. Terr., I, No. 2, ser. 1874, p. 65.

Gomphocerus clypsedra SCUDDER, Daws., Rept. Geol., 49 Par., 1875, p. 344.

Fourteen males and 17 females from the following points in Colorado: Baileys June 30 and July 3; Morrison on June 20, at an elevation of about 7,000 feet; Boulder June 9; Rico August 16; Pine Grove July 18; Pikes Peak July 21; and at Chimney Gulch on July 21.

From a study of these specimens and a long series in the United States National Museum, it seems very clear that there is but one species. There is considerable variation among the different individuals, especially the males, but no characters present themselves that warrant the retention of more than one name. McNeill, in his revision of the Tryxaninae, recognizes two species and gives a table for their separation, using the character of the anterior tibiæ being clavate and distinctly sulcate externally and size small, about 14 mm., to separate *clavatus* from *clypsedra*, which is described as having the fore tibiæ but slightly and regularly expanded apically and size larger, about 18 mm. With these characters in mind I carefully examined the type material in the collection of the United States National Museum, which is composed wholly of male specimens. The type of *clavatus* is 16.5 mm. long and the anterior tibiæ is moderately

expanded, not distinctly clavate, and is very distinctly sulcate externally, but this sulcation is quite obviously due to shrinkage as the left tibia is more conspicuously sulcate than the right one. Such shrinkage is not remarkable as the specimen was alcoholic and described after drying. The describer gives the length as 0.56 inch in length, which is practically 14 mm. But, as above stated, the type really measures 16.5 mm. in length. Why Thomas gave this erroneous measurement is not clear, nor is it clear why McNeill used it as a synoptic character when he had the original type before him.

The type of *carpenterii*, which is an admitted synonym of *clavatus*, is 18 mm. in length, the fore tibiae strongly clavate and not at all sulcate externally. The type of *elypsidra* is not at present in the United States National Museum as mentioned by McNeill, nor is the original type a male from New Mexico, but females from farther north on the Souris River.

The range of variation presented by the types of *clavatus* and *carpenterii* more than covers all variation found among the specimens of *elypsidra*. Therefore if *clavatus* and *carpenterii* are synonymous, and I agree with McNeill in so considering them, *elypsidra* must also be a synonym. That this is a valid conclusion is pretty evident when a long series of specimens from different parts of the country and from various altitudes is examined. The anterior tibiae of the males vary considerably in the amount of apical expansion, though none examined are quite so conspicuously clavate as in the type of *carpenterii*. The elytra of the males are also variable, reaching quite to the tip of the abdomen in some specimens and in others falling noticeably short of it. The elytra of the females also vary in length, but never nearly reach the tip of the abdomen, generally only about as long as the pronotum.

29. BOOPEDON NUBILUM Say.

Cryptus nubilus SAY, Journ. Acad. Nat. Sci. Philad., IV, 1825, p. 308.

This species was found quite abundant in open woodlands in the vicinity of Victoria, Texas, during the latter part of June and in July. Only mature individuals were seen.

30. STIRAPLEURA DECUSSATA Scudder.

Stirapleura decussata SCUDDER, Ann. Rept. Chief Eng., 1876, p. 510.

Nine males, 15 females, Golden May 29; Sedalia June 15 and 21; Denver May 10 to July 16; Baileys July 13; Boulder June 9.

The foveolæ of this species, according to McNeill's tables in his revision of the Tryxalinae, are as long again as wide. Therefore these specimens could be called *delicutula* as justifiably as they are called *decussata*, for the foveolæ are usually but little longer than wide. *Decussata* and *delicutula* may prove to be forms of one species.

31. *AGENEOTETTIX SCUDDERI* Bruner.

Aulocara scudderi BRUNER, Proc. U. S. Nat. Mus., XIII, 1890, pp. 63-64

Sixteen males, twenty-eight females, Golden June 19 to July 27; Denver July 16; Fort Collins August 10; Cripple Creek July 26; Montrose August 17.

32. *AULOCARA ELLIOTTI* Thomas.

Stauronotus ellioti THOMAS, Proc. Acad. Nat. Sci. Philad., 1870, p. 82

Sixty nine males, sixty females, Denver July 16; Morrison July 18; Fort Collins August 10; Golden June 19; Durango August 15; Glenwood Springs July 5; also two apparently full grown female nymphs at Golden on June 19.

This large series of fresh specimens shows a remarkable range of variation, both sexes varying greatly both in color and size. The females are more variable in color while the greatest variation in size occurs in the opposite sex. The posterior femora vary from 10 to 14 millimeters in the males and in the females the color ranges from reddish yellow to fuscous and the elytra of both sexes vary from almost immaculate to quite conspicuously spotted with black. Some of the rufous tinted females approach *parallelum* somewhat, inasmuch as the lateral carinae of the thorax do not seem quite so much constricted mesially as usual and the disk of the pronotum is unicolorous.

33. *AULOCARA FEMORATUM* Scudder.

Aulocara femoratum SCUDDER, Proc. Amer. Acad. Arts Sci., XXXV, 1899, pp. 54, 55-56.

Four males and eight females referable to this species were taken at Fort Collins on August 19 and one pair at Denver on July 11; the latter were taken *en copula*. They all agree in having the elytra much more abbreviated than in *elliotti* and the pronotum is more generally less angulate. The tegmina of the males are immaculate but those of the females are noticeably spotted with black, sometimes however quite dimly so.

SUBFAMILY CEDIPODINÆ.

34. *ARPHIA ARCTA* Scudder.

Arphia Arcta SCUDDER, Bull. U. S. Geol. Surv. Terr., II, 1876, p. 263.

Arphia teporata SCUDDER, Ann. Rept. Chief Eng., 1876, p. 508.

Eleven males, seven females, Golden May 23; Pine Grove July 8 and 18; Baileys July 13; Platte Canyon May 10; Sedalia June 15; Denver May 10. Also collected at Williams, Arizona, on May 27, and June 9. The color of the hind tibial vary in color from clear yellow to blue.

I feel quite sure of the correctness of the above synonymy, and am inclined to believe that *A. frigida* is but a red-winged form of the same species. The type of *teporata* has yellow wings.

35. *ARPHIA LUTEOLA* Scudder.

Arphia luteola SCUDDER, Proc. Bost. Soc. Nat. Hist., XVII, 1875, p. 515.

Quite common in cotton fields about Victoria, Texas.

36. *ARPHIA PSEUDONIETANA* Thomas.

Tomonotus pseudonietani THOMAS, Proc. Acad. Nat. Sci. Philad., 1870, p. 82.

Oedipoda tenebrosa SCUDDER, Rept. U. S. Geol. Surv. Nebr., 1871, p. 251.

Tomonotus tenebrosus THOMAS, Rept. U. S. Geol. Surv. Terr., V, 1873, p. 107.

Arphia sanguinaria STÅL, Rec. Orth., I, 1873, p. 119.

Arphia oraticeps SAUSURE, Add. Prodr. Oedip., 1888, pp. 165-166.

Sixteen males, nine females, Denver July 16; Golden June 19 to August 21; Fort Collins August 10.

From a study of this series of specimens and as many more in the collection of the U. S. National Museum I have decided upon the above synonymy, believing the changes warranted. That *oraticeps* is but a variety of *tenebrosa* is obvious to anyone who has seen this species in numbers, and that the name *pseudonietani* of Thomas was applied first to the species under consideration and should take precedence over *tenebrosa*, described a year later, also seems clear upon investigation of the original descriptions.

When in motion this is one of our most showy locusts, the bright red wings showing very conspicuously as the insect flies before the collector.

37. *ARPHIA FRIGIDA* Scudder.

Arphia frigida SCUDDER, Daws., Rep. geol. 49th par., 1875, p. 344.

Forty-one males, five females, Golden May 20 to June 17; Sedalia June 15; Denver May 10 to June 17; Platte Canyon May 10 to 17; Boulder May 22; Morrison June 29.

38. *CHORTOPHAGA VIRIDIFASCIATA* DeGeer.

Acrydium viridifasciatum DEGEER, Mem., III, 1773, p. 498, pl. XLII, fig. 6.

Both green and brown forms of both sexes occurred quite commonly around Victoria, Texas, in June and July. From specimens observed at this place it would appear that brown individuals occur more often in the male than in the female sex. In Colorado twelve males and eighteen females were taken at Denver, Platte Canyon, and Golden. All these specimens were taken between May 10 and June 10 and were all of the brown form, except four females, and they were particularly brown. Some variation exists in the amount of apical swell-

39. ENCOPTOLOPHUS COSTALIS Scudder.

(*Edipoda costalis* SCUDDER, Bost. Journ. Nat. Hist., VII, 1862, p. 473.

Found in cotton fields at Victoria, Texas, in June and July; not numerous. Six males and two females were taken at Fort Collins on August 9, and two males and two females at Golden on August 21.

The males of this species bear quite a superficial resemblance to *Camnula pellucida*, but the reddish yellow tibiae of the latter will serve to readily separate them. The smaller size, low median carina and, especially in the male, the proportionately broader elytra separate *costalis* from *sordidus*.

40. CAMNULA PELLUCIDA Scudder.

(*Edipoda pellucida* SCUDDER, Bost. Journ. Nat. Hist., VII, 1862, p. 472.

Sixty-eight males, forty-six females, Cumbres August 14; Montrose August 16; Baileys July 13; Rico August 16; Pikes Peak July 21; Cripple Creek July 26; Chama, New Mexico August 14; Pine Grove July 18.

This is a common insect throughout the elevated regions of Colorado.

41. HIPPISCUS MONTANUS Thomas.

(*Edipoda montanus* THOMAS, Ann. Rept. U. S. Geol. Surv. Terr., V, 1872, p. 462.

Three males, two females, Denver May 10. Identified by Professor Bruner. Except for the obscured markings this species is very similar to *H. zapoteco*.

42. HIPPISCUS NEGLECTUS Thomas.

(*Edipoda neglectus* THOMAS, Proc. Acad. Nat. Sc. Philad., 1870, pp. 81-82.

Nineteen males, seven females, Baileys July 13; Chama, New Mexico August 14; Pine Grove July 8; Morrison June 29; Platte Canyon May 25; Chimney Gulch July 27; Pikes Peak July 21.

Three of the males, one from Pikes Peak and two from Baileys, have the posterior tibiae pale yellowish with scarcely a trace of red.

43. HIPPISCUS SAUSSUREI Scudder.

Hippiscus saussurei SCUDDER, Psyche, VI, 1892, pp. 268, 302.

One female specimen at Victoria, Texas, in June.

44. HIPPISCUS TUBERCULATUS Palisot de Beauvois.

Aceridium tuberculatum PALISOT DE BEAUVOIS, Ins. Afr. Amer., 1817, p. 145, pl. iv, fig. i.

One female at Sedalia on June 15.

45. HIPPISCUS ZAPOTECUS Saussure.

Xanthippus zapotecus SAUSSURE, Prodr. Edip., 1884, p. 91

Four males, three females, Denver May 10 to June 17. Professor Bruner is the authority for this determination.

46. LEPRUS CYANEUS Cockerell.

Leprus cyaneus COCKERELL, Ent. News, XIII, 1902, p. 305.

Seven males, one female, Salida August 2-9.

The wings of *L. wheeleri* are a bright yellow, as plainly shown by the types. Therefore, the reference of blue-winged specimens to that species, as has so often been done, is erroneous. *L. cyaneus* is a good species.

47. DISSOSTEIRA CAROLINA Linnæus.

Gryllus (*Locusta*) *carolina* LINNÆUS, Syst. Nat., 10th ed., I, 1758, p. 433.

Common throughout Colorado, specimens being taken on both sides of the mountains from Denver to Grand Junction.

48. DISSOSTEIRA LONGIPENNIS Thomas.

Edipoda longipennis THOMAS, Ann. Rept. U. S. Geol. Surv. Terr., V, 1872, p. 463.

One male at Fort Collins August 9. A common species at times and is reported to come quite freely to light at night.

49. SPHARAGEMON ÆQUALE Say.

Gryllus æquale SAY, Journ. Acad. Nat. Sci. Philad., IV, 1825, p. 307.

Four males, three females, Denver July 16; Golden August 21; Fort Collins August 9. The specimens from Denver, two males, are not typical. They were identified by Prof. A. P. Morse. The median carina of the prothorax is somewhat elevated on the pronotum and scarcely at all on the metanotum, which is flat. The change from the elevated prozona to the scarcely carinate metazona is very abrupt. These specimens are also more slender than usual.

50. SPHARAGEMON ANGUSTIPENNE Morse.

Spharagemon angustipenne MORSE, Psyche, VII, 1895, pp. 295, 298.

One female from Denver on July 16.

51. SPHARAGÉMON COLLARE Scudder.

Orthoporus collaris SCUDDER, Rept. U. S. Geol. Surv., Nebr., 1871, p. 250.

Two females from Golden on June 1.

52. SPHARAGEMON CRISTATUM Scudder.

Spharagemon cristatum SCUDDER, Proc. Bost. Soc. Nat. Hist., XVII, 1875, p. 470.

Several specimens at Victoria, Tex., in June and July.

53. SPHARAGEMON HUMILE Morse.

Spharagemon humile MORSE, Psyche, VII, 1895, p. 292.

Two males, one female, Golden June 18 and August 21.

54. SPHARAGEMON WYOMINGIANUM Thomas.

Cedipoda wyomingianum THOMAS, Ann. Rept. U. S. Geol. Surv. Terr., V, 1872, p. 462.

Three males, Fort Collins August 10; Golden June 18.

55. DEROTMEMA CUPIDINEUM Scudder.

Derotmema cupidineum SCUDDER, Ann. Rept. Chief Eng., 1876, p. 513.

Five males, six females, Montrose August 17; Grand Junction August 17; Palisades July 8.

Not so common as *D. haydeni*, from which it may be separated by the narrower fuscous bands of the wings.

56. DEROTMEMA HAYDENI Thomas.

Cedipoda haydeni THOMAS, Rept. U. S. Geol. Surv. Terr., V, 1871, p. 460.

Thirty-three males, twenty-seven females, Salida August 2 to 6; Montrose August 17; Durango August 15; Denver July 16; Fort Collins August 10; Golden June 19 to August 21; Montevista August 13.

Both red and yellow winged specimens, male and female, were taken. This species is very common in most localities throughout the State. Individuals with yellow wings were the more numerous.

57. MESTOBREGMA BOREALE Saussure.

Psimidia (Trachyrachis) boreale SAUSSURE, Prodr. (Edip.), 1884, p. 164.

One female, Golden June 5.

The conspicuous character of this species is the unusually rugose pronotum. The top of the head is marked with several tortuous carinæ and the frontal costa is traversed by a carina just below the ocellus. The wings are yellow at the base and the tip is hyaline; transverse black band a fourth as wide as the length of the wing with the costal shoot extending three-fourths of the way to the base; elytra regularly mottled with quite large fuscous spots. The posterior tibiæ are yellow.

58. MESTOBREGMA FUSCIFRONS Stål.

Psimidia fuscifrons STÅL, Rec. Orth., I, 1873, p. 134.

Specimens of this species were collected in cotton fields at Victoria, Texas, in June.

59. MESTOBREGMA KIOWA Thomas.

Edipoda kiowa THOMAS, Ann. Rept. U. S. Geol. Surv. Terr., V, 1872, p. 461.

Specimens, both mature and immature, were taken on the summit of Pikes Peak on snow fields, and a number of mature individuals of both sexes were taken at the following places in Colorado and New Mexico: Montervista August 13; Chama, New Mexico August 14; Fort Collins August 9; Denver July 16; Golden June 19; Morrison June 23.

But one specimen, a female, was taken at Montervista, and its wings are pale citron basally. The same is true of four males from Chama, New Mexico, but all the others have the base of the wings hyaline. This appears to be quite constantly the case with specimens from opposite sides of the divide.

60. MESTOBREGMA PLATTEI Thomas.

Edipoda plattei THOMAS, Rept. U. S. Geol. Surv. Terr., V, 1873, p. 123.

Seven males, seventeen females, Denver July 26; Chimney Gulch July 27; Pine Grove July 23; Golden June 6 and August 21.

The distinguishing feature of this species seems to be the pallid coloring of the inferior posterior part of the lateral lobes of the thorax and the bands of the tegmina extending only across the costal half. The elytral markings resemble those of *Trimerotropis pseudofuscatus*.

61. MESTOBREGMA PULCHELLA Bruner.

Mestobregma pulchellum BRUNER, Proc. U. S. Nat. Mus., XII, 1890, p. 64-65.

One male at Fort Collins August 9. This specimen agrees in every particular with Bruner's type in the U. S. National Museum. This species was omitted from Scudder's catalogue. It is a true *Mestobregma*, and is very closely allied to *M. kiowa* in markings, and may prove to be a synonym of that species. The color is its most distinguishing feature, and that may be due to environment. The food plant from which it was described, *Eurotia lunata*, is recorded as occurring from the "Northwest Territories to western Nebraska, New Mexico, Nevada, and California."

62. METATOR PARDALINUM Saussure.

Edipoda pardalinum SAUSSURE, Rev. Mag. Zool., XIII, 1861, p. 324.

Nineteen males, twelve females, Fort Collins August 11; Morrison June 29; Golden June 19 and 30.

Nine males and six females having the base of the wings yellow, but in every other particular like the red-winged specimens, were taken at the same localities and on the same dates. Very probably these yellow-winged forms are the *Mestobregma maculosum* of Saussure.

63. *PSINIDIA SULCIFRONS* var.-*AMPLICORNUS*, new variety.

(Plate LV, fig. 2.)

Superficially resembling *P. sulcifrons*, but differing from typical specimens in several particulars. Color grayish mottled with fuscous; head as in *sulfifrons*; the antennæ are fuscous and greatly depressed in both sexes, and nearly twice as broad as those of typical *sulfifrons*; pronotum and elytra about as in *sulfifrons*, except that the posterior margin of the pronotum of the female is apparently more sharply angulate. Wings with the black band usually somewhat wider than in *sulfifrons*, leaving slightly less of the tip free, the tip infuscated, more so in the male. Posterior femora slender and more flattened, the dorsal carina much more elevated and thinner than in typical *sulfifrons*; the posterior tibiæ are quite uniformly blue, paling somewhat basally, those of the female much lighter colored than those of the male. The color of the tibiæ may be expected to vary considerably in coloration when a number of specimens are examined. The size is about the same as that of *sulfifrons*, the measurements of the type specimens being as follows:

Length of body, male, 21 mm., female, 28; antennæ, male, 12 mm., female, 13 mm.; elytra, male, 19 mm., female, 24 mm.; posterior femora, male, 13 mm., female 16 mm.

One male, one female, Victoria, Texas, June, 1902.

Type No. 6602, U.S.N.M.

64. *CONOZOA WALLULA* Scudder.

Psiniidia wallula SCUDDER, Rept. U. S. Ent. Comm., II, app., 1881, pp. 27-28, pl. XVII, figs. 13, 14.

Thirteen males, four females, Grand Junction July 7 and August 17; Montrose August 17.

65. *TRIMEROTROPIS BRUNERI* McNeill.

Hadrotettix grueilis SCUDDER, Psyche, IX, 1900, pp. 67-68.

Trimerotropis bruneri McNEILL, Psyche, IX, 1900, p. 31.—SCUDDER, Proc. Davenport Acad. Nat. Sc., IX, 1902, p. 37.

Two females, Sedalia July 11.

66. *TRIMEROTROPIS CITRINA* Scudder.

Trimerotropis citrina SCUDDER, Bull. U. S. Geol. Surv. Terr., II, 1876, p. 265.

This species has been taken at various places in Colorado. One male specimen taken at Golden has the black band on the wing somewhat broader than usual.

67. TRIMEROTROPIS GRACILIS Thomas.

Oedipoda gracilis THOMAS, Ann. Rept. U. S. Geol. Surv. Terr., V, 1871, p. 461.

Derotnema lichenosum SCUDDER, Proc. Amer. Acad. Arts Sci., XXXV, 1900, pp. 394-395.

Eight males, four females, Durango August 15.

The color of this insect makes it almost invisible when at rest on the naked ground.

68. TRIMEROTROPIS LATICINCTA Saussure.

Trimerotropis laticincta SAUSSURE, Prodr. CEdip., 1884, pp. 169, 170.

Two males, three females, Fort Collins August 19; one male, two females, Montrose August 13; one male, Grand Junction August 17; two females, Denver July 16; one female, Baileys July 30; two males, Golden August 21.

The males are somewhat variable in size. the measurements of the elytra ranging from 24 to 29 mm. It was quite unexpected to find this species so common and widely distributed. By the table given by McNeill these specimens run very persistently to this species.

69. TRIMEROTROPIS MODESTA Bruner.

Trimerotropis modesta BRUNER, Proc. U. S. Nat. Mus., XII, 1890, p. 72.

Six males, two females, Durango August 13; and Golden July 27.

The type of this species has the elytral bands quite distinct, decidedly more so than the greater number of specimens. At Golden it occurred up in the gulch in the foothill fauna. This is the first record of its occurrence east of the Rocky Mountains.

70. TRIMEROTROPIS MONTICOLA Saussure.

Trimerotropis monticola SAUSSURE, Prodr. CEdip., 1884, p. 170.

Seven males, five females, Cripple Creek July 26; Baileys July 13; Golden June 17 and July 27; Pikes Peak July 21; Denver July 22.

One of the females from Baileys has the black transverse band of the wing scarcely one-sixth as broad as the length of the wing and interrupted along the first anal vein. This specimen is also smaller than usual, the elytra measuring 25 mm. and the posterior femora 12 mm. All the specimens are from the foothill fauna except those from Denver. These Denver specimens, however, agree perfectly with specimens from Pikes Peak and other high altitudes.

71. TRIMEROTROPIS PSEUDOFASCIATA Scudder.

Trimerotropis pseudofasciata SCUDDER, Ann. Rept. Chief Eng., 1876, p. 514.

Eight males, four females, Chimney Gulch July 27; Pine Grove July 23; Salida August 1; Durango August 15.

The posterior tibiae of this species vary in color from yellow to distinctly blue. The type, according to McNeill, should be in the collection of the National Museum but can not now be found.

72. *TRIMEROTROPIS SIMILIS* Scudder.

Trimerotropis similis SCUDDER, Rept. U. S. Ent. Comm., II, app., 1881, p. 27.

Ten males, three females, Platte Canyon May 23; Pine Grove July 8; Palisades July 8; Salida August 6; Golden July 11; Chimney Gulch July 27; Morrison June 27.

All these specimens were taken in the foothill fauna, and they do not seem to occur on the prairie. There is some variation in the elytral bands, some specimens having them much more contrasted than others.

73. *TRIMEROTROPIS VINCULATA* Scudder.

Trimerotropis vinculata SCUDDER, Proc. Bost. Soc. Nat. Hist., XVIII, 1876, p. 270.

Twenty males, fifteen females, Platte Canyon May 25 and July 10; Sedalia July 11; Montrose August 17; Montevista August 13; Salida August 6; Palisades July 8; Delta July 9; Fort Collins August 9; Denver June 21; and Grand Junction July 7.

74. *CIRCOTETTIX AZURESCENS* Bruner.

Trimerotropis azurescens BRUNER, Proc. U. S. Nat. Mus., XII, 1890, pp. 69-70.

Trimerotropis perplexa BRUNER, Proc. U. S. Nat. Mus., XII, 1890, pp. 74-75.

One male, Montrose August 17; one female, Fort Collins August 10.

This is a true circotettix, the radials of the wings being distinctly swollen. The above synonymy is based upon a study of type specimens.

75. *CIRCOTETTIX CARLINIANUS* Thomas.

Edipodu carlinianus THOMAS, Proc. Acad. Nat. Sci. Philad., 1870, p. 81.

Six males, eight females, Fort Collins August 10; one male, Morrison June 29.

One of the male specimens has the hyaline portion of the wings extending quite to the base in the anterior and middle fields.

76. *CIRCOTETTIX SUFFUSUS* Scudder.

Trimerotropis suffusus SCUDDER, Bull. U. S. Geol. Surv. Terr., II, 1876, p. 265.

Trimerotropis columbian SCUDDER, Rept. Ent. Soc. Ont., XXIII, 1893, p. 77.

Three males, one female, Chama, New Mexico August 14.

77. *CIRCOTETTIX UNDULATUS* Thomas.

Edipodu undulatus THOMAS, Ann. Rept. U. S. Geol. Surv. Terr., V, 1871, p. 460.

Twenty-six males, twenty females, Chimney Gulch June 19; Baileys July 13; Pine Grove July 18 and 27; Golden, in foothills, July 27;

Chama, New Mexico August 14; Rico August 16; Cumbres August 14; Durango August 15; Pikes Peak July 21; Cripple Creek July 26.

This common species is one of the noisiest insects that inhabit the canyons.

78. *CIRCOTETTIX VERRUCULATUS* Kirby.

Locusta verruculatus KIRBY, Faun. Bor. Amer., IV, 1837, p. 250.

Eight males, one female, Pine Grove July 16 and 23; Platte Canyon May 25.

This is even a more noisy species than *C. undulatus*. They fly during the hottest part of the day and the sharp crackling noise made by their wings may be heard for long distances. On quiet days I have distinctly heard them for almost or quite half a mile. Often they will remain suspended almost stationary in the air, making the welkin ring with their shrill crackling.

79. *HADROTETTIX TRIFASCIATUS* Say.

Gryllus trifasciatus SAY, Amer. Ent., III, 1828, p. 78, pl. xxxiv.

One female at Victoria, Texas on July 10, and many specimens of both sexes, both mature and immature, in Colorado at Denver, Golden, and Fort Collins from June 7 to August 10.

This is apparently not a common insect in southern Texas, though farther north it is very common, as indicated by the above records. At Victoria I saw but the one specimen and no nymphs.

80. *HELIASTUS GUANIERI*, new species.

(Plate LV, fig. 3.)

Of small size, pale testaceous, scarcely paler below. Head prominent, nearly smooth, face almost perpendicular; eyes small, subglobular, about half as long as the infraocular part of the genæ; antennæ long, about four-fifths as long as the posterior femora, fine and filiform in the female, coarser and slightly flattened apically in the male. Pronotum constricted mesially, flaring both in front and behind, anterior margin slightly rounded, mesially subimmarginate, posterior margin obtuse-angularly rounded; median carinæ almost obsolete except on the metanotum where it is present as a fine raised line; lateral carinæ present only posterior of the typical sulcus and there very rounded; descending lobes of the pronotum apically subtruncate, in no wise descending below the free pleural lobes anterior to them. The tegmina extend to or slightly beyond the tips of the hind femora and are quite broad, about one-fifth as broad as long, the tips well rounded and the anterior and posterior margins about equally rounded, uniformly pale testaceous or with more or less maculation, along the posterior margin generally with separate and distinct fuscous spots. Intersternary vein absent. Wings hyaline, veins greenish. Fore and

middle legs more or less distinctly banded with black, posterior femora pale testaceous, paler below and on the inner side, dorsally and on the upper part of the outer face marked by two oblique dark bands, one median and one subapical; hind tibiæ red, paling somewhat on the basal fourth; spines red at the base, the apical half black.

Length of body, male, 14 mm.; female, 19–20 mm.; antennæ, male, 7.5 mm.; female, 8 mm.; elytra, male, 11 mm.; female, 15–16 mm.; hind femora, male, 9 mm.; female, 9.5–10 mm.

Type.—No. 6600, U.S.N.M. Described from specimens from Colorado collected by G. Guenier at Pueblo many years ago. I collected one specimen, a female, at Fort Collins, on August 11, and the U. S. National Museum contains specimens from Douglas County, Kansas, and others labeled “Colorado.”

This species is probably the nearest allied to *Heliastus minimus*, but the long antennæ and the red hind tibiæ, together with the habitat, will serve to separate them.

Regarding the posterior tibiæ of *H. minimus*, Professor Morse writes me as follows: “Hind tibiæ of *Heliastus minimus* are luteous—pale yellowish buff—probably almost ivory white in life.”

81. BRACHYSTOLA MAGNA Girard.

Brachypeplus magnus GIRARD, Marcy, Expl. Red River, 1853, p. 260, pl. xv, figs. 1–4.

Several specimens, mature and immature, at Golden, on poppy plants in July. *Brachypeplus virescens* Charpenter is very probably a synonym of this species. If such should prove the case, the name *virescens* would have preference, being established several years previous to *magna*.

Subfamily ACRIDIINÆ.

82. TÆNIPODA PECTICORNIS Walker.

Rhomalea pecticornis WALKER, Cat. Derm. Salt., III, 1870, p. 538.

Tæniopoda pecticornis STÅL, Rec. Orth., I, 1873, p. 51.—THOMAS, Rept. U. S. Geol. Surv. west 100 merid., V, 1875, p. 898.—SCUDDER and COCKERELL, Proc. Davenport Acad. Sci., IX, 1902, p. 39.

Specimens of this fine insect were sent to the Division of Entomology by Mr. E. Meyenberg, of Pecos, Texas, with the statement that they were taken at the base of the foothills of the Guadalupe Mountains.

This species does not appear in Scudder's catalogue.

83. DICTYOPHORUS RETICULATUS Thunberg.

Dictyophorus reticulatus THUNBERG, Mem. Acad. St. Petersburg., V, 1815, p. 259.

This handsome insect is quite common in some cotton fields about Victoria, Texas, where it matures about the end of June. The con-

spicuously marked nymphs are no less striking in appearance than the mature individuals, in fact being easier seen at a distance than the imagoes.

An apparently unrecorded fact regarding this species was noted in the field. Both sexes, but especially the males, when disturbed make a distinct simmering or bubbling sound, high-noted, but of small volume. Upon investigation, this sound was found to proceed from a gland, probably a modified spiracle, opening from the side of the body above and slightly behind the middle coxæ. The sound is produced by the insects forcing out very minute bubbles of a clear liquid, causing a sound sufficiently loud to be heard for some distance. Whether this liquid has repelling properties and the resulting sound purely mechanical, or whether the production of sound is the main object of the mechanism, was not determined.

84. *SCHISTOCERCA ALUTACEA* Harris.

Aceridium alutacea HARRIS, Ins. Inj. Veg., 1841, p. 139.

One female specimen at Grand Junction August 17, and one male by Oslar, labeled "Colorado."

85. *SCHISTOCERCA AMERICANA* Drury.

Gryllus americana DRURY, Ill. Nat. Hist., I, 1770, p. 128, pl. XLIX, fig. 2.

This species is quite common at times in the cotton fields of Texas. Several specimens were taken at Victoria in June and July.

86. *SCHISTOCERCA OBSCURA* Fabricius.

Gryllus obscura FABRICIUS, Suppl. Ent. Syst., 1798, p. 194.

One large female from Quero, Texas July 11.

87. *SCHISTOCERCA SHOSHONE* Thomas.

Aceridium shoshone THOMAS, Proc. Acad. Nat. Sci. Philad., 1873, p. 165.

Two large females from Yuma, Arizona, and one male from Phoenix, Arizona. Immersion in alcohol seems to discolor these insects to a considerable extent, changing the green to light brown and the color of hind tibiæ from red to yellow.

88. *PARAIDEMONA MIMICA* Scudder.

Paraideмона mimica SCUDDER, Proc. U. S. Nat. Mus., XX, 1897, pp. 42, 43-44, pl. III, fig. 10.

Many specimens of both sexes in cotton fields in the vicinity of Victoria, Texas, in June and July. This seems to be the common species in that section of the State, no other species being represented among the many specimens examined. It is quite variable, both in size and coloration.

89. *HYPOCHLORA ALBA* Dodge.

Pezotettix alba DODGE, Can. Ent., VIII, 1876, p. 10.

Two males and three females at Fort Collins August 9, and one female at Boulder on August 13.

90. *HESPEROTETTIX PRATENSIS* Scudder.

Hesperotettix pratensis SCUDDER, Proc. U. S. Nat. Mus., XX, 1897, pp. 57, 64-66, pl. v, fig. 3.

Four males, two females, Pine Grove July 18, and Grand Junction July 7.

91. *HESPEROTETTIX SPECIOSUS* Scudder.

Pezotettix speciosus SCUDDER, Rept. U. S. Geol. Surv. Nebr., 1871, p. 250.

Found quite common in long grass in southern Texas in June and July. It apparently matures in that section about the end of June. A number of specimens were taken in cotton fields.

92. *HESPEROTETTIX VIRIDIS* Thomas.

Caloptenus viridis THOMAS, Ann. Rept. U. S. Geol. Surv. Terr., V., 1872, p. 450, pl. II, fig. 3.

Ten males, nineteen females, Pikes Peak July 21; Golden June 19 to August 21; Fort Collins August 11; Denver July 16.

Males of this species are quite variable in size.

92. *ÆOLOPLUS CHENOPODII* Bruner.

Pezotettix chenopodii BRUNER, Ins. Life, VII, 1894, pp. 41-42.

Numerous specimens of this interesting species were taken at Palisade July 8 in a patch of low prickly shrubs just across the railroad from the station, which I suppose is the Chenipodaceous plant on which the species was originally recorded as feeding. Specimens were also taken at Grand Junction and Delta. They were seen mating at the latter place on August 17, and on the latter date some apparently full grown nymphs were taken. These nymphs were uniformly light yellowish in color and the thorax more tectiform than in mature individuals. Among the mature specimens taken were some individuals almost unicolorous, without fuscous markings.

94. *ÆOLOPLUS PLAGOSUS* Scudder.

Pezotettix plagosus SCUDDER, Ann. Rept. Chief Eng., 1876, p. 504.

Numerous specimens from the side of Tenderfoot Mountain, just across the railroad from the station at Salida from August 1 to 7. They were very common and frequently found mating. One female specimen was also taken at Sedalia and the color of that specimen is of

a decidedly yellowish cast, radically different from the dark-brown color that characterized all the *Salida* specimens except one which was colored similar to the *Sedalia* specimen.

95. *ÆOLOPLUS REGALIS* Dodge.

Caloptenus regalis DODGE, Can. Ent., VIII, 1876, pp. 11, 12.

Four males, four females, Fort Collins August 10.

Some specimens have the elytra greenish, but generally they are brownish. One pair was taken mated.

96. *ÆOLOPLUS TURNBULLI* Thomas.

Caloptenus turnbulli THOMAS, Ann. Rept. U. S. Geol. Surv. Terr., V., 1872, p. 452, pl. II, fig. 10.

One male, one female, Delta July 13.

These specimens are unusually brachypterous, the elytra covering but little more than half of the abdomen. The female is also smaller than usual, but otherwise both specimens are typical. The posterior tibiae are variable in color, those of the female greenish yellow with a pallid subbasal annulus, while those of the male are testaceous merging into pale reddish on the basal third. The measurements of these two specimens are as follows:

Length of body, male and female, 16 mm.; antennae, male, 5 mm.; female, 4 mm.; pronotum, male and female, 3.5 mm.; elytra, male and female, 7 mm.; posterior femora, male, 7.5 mm.; female, 8 mm.

97. *MELANOPLUS ALTITUDINUM* Scudder.

Pezotettix altitudinum SCUDDER, Proc. Bost. Soc. Nat. Hist., XX, 1879, p. 86.

Melanoplus huxtoni BLATCHLEY, Psyche, VIII, 1898, pp. 195, 196.

Seven males, eight females, Pine Grove July 18, at the head of a side gulch nearly a thousand feet above the town. Also one pair from Pikes Peak July 21, one female above Boulder June 9, and one male above Golden June 17.

The elytra of these specimens are somewhat variable in length, in the male sex varying from 4.75 to 6 mm. There are several specimens of this species in the United States National Museum named by Dr. Scudder, and the male tegmina vary from 5.5 to 9.5 mm. and the female tegmina vary from 7.5 to 11 mm. in length. But these higher measurements seem exceptional, the usual length of elytra being about 6 mm. in the males and 7 mm. in the females. Types of *Melanoplus huxtoni* Blatchley are in the National Museum and seem to be identical with specimens of *altitudinum* from various localities in the West. It is not clear why Dr. Scudder placed this species in the *Borekii* series of the genus, as it surely does not belong there.

98. MELANOPLUS ATLANIS Riley.

Caloptenus atlantis RILEY, Ann Rept. Ins. Mo., VII, 1875, p. 169.

This species was taken at various points in Colorado on both sides of the divide. Specimens were also taken on the summit of Pikes Peak on snow fields on July 20. The color of the posterior tibiae vary from bright red to yellow and blue.

99. MELANOPLUS BIVITTATUS Say.

Gryllus bivittatus SAY, Journ. Acad. Nat. Sci. Philad., IV, 1825, p. 308.

Six males, twelve females, Denver July 16; Golden June 19 and August 21; Fort Collins August 10.

A pair from Fort Collins is brachypterous, the wings covering but little more than half of the abdomen. The male is quite small, measuring as follows:

Length, 22 mm.; elytra, 9 mm.; hind femora, 12 mm.

100. MELANOPLUS BOWDITCHI Scudder.

Melanoplus bowditchi SCUDDER, Proc. Bost. Soc. Nat. Hist., XX, 1879, p. 72.

Two males, six females, Fort Collins August 9; Salida August 6; also one male from Williams, Arizona. The Colorado specimens have the male furcula shaped considerably like those of *M. pictus* as illustrated on Plate XI of Scudder's Revision of the Melanopli. The specimen from Arizona has these organs more rounded out on the inner side than usual. Some specimens from Salida are in the collection of the Colorado Agricultural College labeled "bowditchi or n. sp."

101. MELANOPLUS COCCINEIPES Scudder.

Melanoplus coccineipes SCUDDER, Proc. Amer. Phil. Soc., XXXVI, 1897, pp. 26, 34.

Thirteen males and eleven females from Golden, Denver, and Fort Collins from July 11 to August 23.

102. MELANOPLUS COLLINUS Scudder.

Melanoplus collinus SCUDDER, Proc. Bost. Soc. Nat. Hist., XIX, 1878, p. 285.

One male specimen taken at Fort Collins August 10. This specimen is indistinguishable from specimens from Virginia and Canada. It has not, I believe, been recorded from Colorado before.

103. MELANOPLUS COLORADUS, new species.

(Plate LV, Figs. 1, 1a.)

One male specimen from Palisade July 8.

Of medium size, testaceous, very closely related to *M. propinquus* in general appearance. Head quite prominent; flavo-testaceous, darker

above with a scarcely discernible trace of a postocular band, though with more specimens there would probably be some variation in this respect. The vertex is tumid and slightly elevated above the thorax; interspace between the eyes about as broad as the basal segment of the antennæ; frontal costa subequal, flat, biserially punctate above the ocellus, below shallowly sulcate, just failing to reach the clypeus; eyes moderately prominent, a little longer than the infracular part of the genæ; antennæ flavo-testaceous, about three-fourths as long as the posterior femora. Pronotum very slightly enlarging from in front backward, the carinæ as in *M. propinquus*; color testaceous with a black postocular band on the prozona, not extending onto the metazona; front margin truncate, scarcely at all flaring, hind margin obtusangulate. Prosternal spine and mesosternal foramine as in *propinquus*. Tegmina considerably passing the posterior femora, very slender in form and uniformly testaceous, immaculate. Fore and middle femora considerably swollen, hind femora very pale testaceous above, paler below, without bands, but with black genicular arcs. Posterior tibiæ uniformly red, spines wholly black, eleven in number in the outer series. Extremity of abdomen quite noticeably clavate, moderately recurved, the supraanal plate strongly depressed apically, almost hidden by the more than usual developed pallium, lateral margins moderately elevated, median sulcus moderately deep with narrow, elevated margins; furcula two-thirds as long as the supraanal plate, broad and touching at the base for a third of their length and quite thin, narrowing abruptly to half their basal width and continuing as cylindrical oval terminating fingers, slightly curving inward; cerci relatively broader than those of *propinquus*, tapering more on the upper side than on the lower and obliquely truncate apically, the upper edge of the apex bluntly acute; subgenital plate as in *propinquus*.

Length of body from head to tip of the abdomen, 21 mm., antennæ, 8 mm., elytra, 18 mm., hind femora, 12 mm.

Type.—No. 6599, U.S.N.M.

The broader cerci, pallid lower surface of the posterior femora, and the habitat will serve to separate this species from its nearest ally, *M. propinquus*. It belongs to the *femur rubrum* series.

104. MELANOPLUS DIFFERENTIALIS Thomas.

Arridium differentialis THOMAS, Trans. Ill. St. Agric. Soc., V. 1865, p. 450.

Many specimens at Victoria, Texas in June and July and on both sides of the divide in Colorado. At Grand Junction I took a number of fine large specimens of both sexes on August 17 that were uniformly brownish in color and very large. In Texas they were very numerous along roadsides in rank weeds, flying up in swarms at the approach of the buggy. In the streets of Denver black individuals were taken on several occasions.

105. *MELANOPLUS FASCIATUS* Walker.

Culoptenus fasciatus WALKER, Cat. Derm. Salt., IV, 1870, p. 680.

Two males at Pine Grove on July 18.

106. *MELANOPLUS FEMUR-RUBRUM* De Geer.

Acridium femur-rubrum DE GEER, Mem., III, 1773, p. 498, pl. XLII, fig 5.

Two males, twenty-seven females, Montevista August 13; Golden August 23; Fort Collins August 10; Denver July 16; Montrose August 13; Glenwood Springs August 18; Grand Junction August 17; Palisade July 8; Mancos August 16.

107. *MELANOPLUS FLABELLATUS* Scudder.

Melanoplus flabellatus SCUDDER, Proc. Bost. Soc. Nat. Hist., XX, 1879, pp. 82-83.

This species was found mating in considerable numbers in the edge of an open piece of woods near Victoria, Texas on June 28.

108. *MELANOPLUS FLAVIDUS* Scudder.

Melanoplus flavidus SCUDDER, Proc. Bost. Soc. Nat. Hist., XX, 1879, p. 74.

Nine males, thirteen females, Golden June 19 and August 21; Fort Collins August 11.

Some of these specimens are quite brightly yellowish and others are quite uniformly brown, except the posterior tibiae. Some specimens have the lateral lobes of the pronotum with a black postocular band and some are unicolorous. All have the hind femora bifasciate with fuscous above.

109. *MELANOPLUS GLADSTONI* Scudder.

Melanoplus gladstoni SCUDDER, Proc. Amer. Phil. Soc., XXXVI, 1897, pp. 23, 33.

Eleven males, ten females, Golden August 21; Fort Collins August 9.

The specimens from Colorado and Nebraska mentioned by Scudder on page 230 of his revision of the *Melanopli* agree exactly with this lot from Colorado, otherwise these would have been treated of here as *conspersus*, for *gladstoni* and that species must be very similar, in fact, Colorado specimens in the collection of the Colorado Agricultural College are labeled as *conspersus*. The cerci of some of the specimens, both of the present lot from Colorado and those mentioned above from Nebraska, are apically bent inward at almost a right angle. It may be that they are the true *conspersus*, and *gladstoni* occurs only further north. Or, still more likely, *gladstoni* and *conspersus* are forms of one variable species. To settle this the type of *conspersus*, or typical examples, must be seen.

110. MELANOPLUS INFANTILIS Scudder.

Melanoplus infantilis SCUDDER, Proc. Bost. Soc. Nat. Hist., XX, 1879, pp. 65-67.

Ten males, eight females, Baileys July 13; Cripple Creek July 26; Fort Collins August 10; Morrison June 27; Denver July 16.

111. MELANOPLUS INTERMEDIUS Scudder.

Melanoplus intermedius SCUDDER, Proc. Amer. Phil. Soc., XXXVI, 1897, pp. 20, 32.

Twenty males, nineteen females, Montrose August 17; Glenwood Springs August 18.

112. MELANOPLUS LAKINUS Scudder.

Pezotettix lakinus SCUDDER, Proc. Bost. Soc. Nat. Hist., XX, 1879, pp. 79-80.

Six males, four females, Fort Collins, August 9. One pair mating.

113. MELANOPLUS LATIFERCULA, new species.

(Plate LV, fig. 4, 4a.)

One male from Cumbres, Colorado, August 14.

A brachypterous species of small size and very dark fuscous in color; head moderately prominent, dark fuscous above and on the upper portion of the genæ, elsewhere dark ashen except for a broad piceous postocular band; vertex elevated considerably above the pronotum, somewhat tumid; interspace between the eyes noticeably broader than the basal segment of the antennæ; frontal costa but slightly broader than the space between the eyes, with the margins parallel and punctate throughout, very shallowly sulcate at and below the ocellus, just failing to reach the clypeus; eyes neither large nor prominent, a little longer than the infraocular part of the genæ. Antennæ fuscous, two-thirds as long as the posterior femora. Pronotum subequal, very slightly enlarging posteriorly, uniformly dark fuscous except for a broad, slightly broken, postocular stripe which does not extend on to the metanotum; the disk passes into the perpendicular lateral lobes with an abrupt turn, making the lateral carinæ well marked; front border truncate, in no wise flaring to receive the head; posterior border very obtusely angled, the angle rounded; prosternal spine short, erect, subquadrate, and bluntly rounded at the apex; interspace between the mesosternal lobes quadrate, metasternal lobes approximate. Tegmina abbreviate, but little longer than the pronotum, overlapping and apically pointed, immaculately fuscous; fore and middle femora quite strongly tumid, the anterior ones the more so; hind femora quite stout, dark fuscous except below where they are dark red, with darker geniculations preceded by a pallid band; spines black to the base, ten in number in the outer series. Tip of the abdomen scarcely clavate, considerably upturned, the supraanal plate apically

concealed by the ample pallium and with the sides partially hidden beneath the short broad infracercal plates which overlie the borders of the supraanal plate in this species; the median sulcus narrow with moderately elevated margins; furcula well developed, half as long as the supraanal plate and very broad, nearly half as broad as long, touching at the base and narrowed distally to a broadly rounded apex, the narrowing more on the inner side; cerci very broad, about twice as long as the basal width, tapering but little and that on the under side of the apical third, the tip broadly rounded, the whole gently upcurved but scarcely inclined inwards; subgenital plate black, the tip elevated a little above the lateral margins and narrowly and shallowly but distinctly notched.

Length of body, 16 mm.; antennæ, 6.5 mm.; pronotum, 4 mm.; elytra, 5 mm.; hind femora, 9.5 mm.

Type.—No. 6601 U.S.N.M.

This species appears to belong to the *maucus* series.

114. *MELANOPLUS MINOR* Scudder.

Culoptenus minor SCUDDER, Proc. Bost. Soc. Nat. Hist., XVII, 1875, p. 478.

Sixteen males, sixteen females, Glenwood Springs July 5; Sedalia June 15 and 21; Denver July 16.

115. *MELANOPLUS OCCIDENTALIS* Thomas.

Culoptenus occidentalis THOMAS, Ann. Rept. U. S. Geol. Surv. Terr., V, 1872, p. 453, pl. II, fig. 2.

Seventy-four males, forty-nine females, Cripple Creek July 26; Morrison June 29; Golden June 19 and July 11; Boulder June 9; Durango June 12; Denver July 16; Pikes Peak July 21; Fort Collins August 10; Baileys July 30; Sedalia June 21; Glenwood Springs July 5.

Though the type of both this species and *M. cuneatus* are in the Museum collection I can find no stable character for separating them. The latter is the larger species, considering only the types, but with a series, such as the one now before me, that is seen to be inadequate for their separation. As for the tubercled subgenital plate of *occidentalis*, as given by Scudder for the separation of that species from *cuneatus*, I must confess an inability to make anything out of it. The cerci of *cuneatus* seem however to be shorter and inferiorly more lobed than in *occidentalis*.

The males of this species, as represented by this series, vary in measurements as follows:

Length of body, 19 to 23 mm.; elytra, 8.5 to 16 mm.; hind femora, 10 to 11 mm. The specimen from which the minimum measurement of the elytra was taken was collected at Glenwood Springs on July 5, and is an unique specimen of its kind so far as recorded, no other known individual having elytra less than 12 mm. in length.

116. *MELANOPLUS PACKARDII* Scudder.

Melanoplus packardii SCUDDER, Proc. Bost. Soc. Nat. Hist., XIX, 1878, p. 287.

One female specimen in cotton field at Victoria, Texas, in late June; apparently not very common. In Colorado specimens of both sexes were taken at the following places: Denver July 16; Golden August 21 and Morrison June 28.

117. *MELANOPLUS PLUMBEUS* Dodge

Chloptenus plumbeus DODGE, Can. Ent., IX, 1877, p. 12.

Seventeen males, nine females, Denver July 16.

The elytra of some specimens are almost fuscous and distinctly maculate, and the general color varies from fuscous to flavous. But the flavous stripe on a darker background is constant, and specimens of this species can be separated from *femur-rubrum* with considerable certainty by that character and the general appearance. But those two species are very close and may prove to be forms of the same thing.

118. *PHOETALIOTES NEBRASCENSIS* Thomas.

Pezotettix nebrascensis THOMAS, Ann. Rept. U. S. Geol. Surv. Terr., V, 1872, p. 455.

Seven males, six females, Fort Collins August 10. One pair is macropterous, but all the rest are brachypterous.

119. *PAROXYA FLORIDANA* Thomas.

Chloptenus floridana THOMAS, Bull. U. S. Geol. Surv. Terr., I, 1874, pp. 2, 68.

Two females, Victoria, Texas, in June, 1902. These specimens are typical in having the fuscous stripe of the lateral lobes of the pronotum abruptly terminated at the posterior sulcus. Specimens of this species taken in numbers at Rosslyn, Virginia, usually have this stripe percurrent, though behind the posterior sulcus it is not generally so well defined.

120. *DACTYLOTUM PICTUM* Thomas.

Pezotettix pictum THOMAS, Proc. Acad. Nat. Sci. Philad., 1870, p. 78.

A few specimens of both sexes, also nymphs, at Denver, July 26; Golden, July 27; and Fort Collins, August 10.

Family LOCUSTIDÆ.

121. *ARETHÆA PHALANGIUM* Scudder.

Agipan phalangium SCUDDER, Proc. Bost. Soc. Nat. Hist., XIX, 1877, p. 40.

Three females were taken in the vicinity of Victoria, Texas, in the latter part of June, 1902. They were all flying in open prairies, and other specimens were seen but not taken. They do not usually take long flights, generally no more than 50 or 100 yards. There is some variation in the radial branches of the elytra, the *multiramosa* of Branner representing such variation.

122. SCUDDERIA CURVICAUDA De Geer.

Locusta curvicauda DE GEER, Mem., III, 1773, p. 446, pl. xxxviii, fig. 3.

One pair at Victoria, Texas, in June.

123. SCUDDERIA FURCATA Brunner.

Scudderia furcata BRUNNER, Monogr. Phaner., 1878, p. 239, pl. v, fig. 72a.

One mature female by E. J. Osler, marked "Colorado," and one immature specimen which probably belongs to this species was taken at Golden on July 18.

124. SCUDDERIA TEXENSIS Saussure and Pictet.

Scudderia texensis SAUSSURE and PICTET, Biol. Cent.-Amer., Orth., 1897, I, pp. 328, 329, 330, pl. xv, figs. 18, 19.

One female at Victoria in June, 1902.

125. AMBLYCORYPHA HUASTECA Saussure.

Phylloptera huasteca SAUSSURE, Rev. Mag. Zool., XI, 1859, p. 205

Quite common in lowlands in southern Texas. A number of specimens were taken near Victoria, and in early July I saw hundreds of them taking short flights over a piece of low prairie.

126. AMBLYCORYPHA UHLERI Stål.

Amblycorypha uhleri STÅL, Bih. Sv. Vet.-akad. handl., IV, 1876, No. 5, p. 57.

Several specimens at Victoria in June.

127. MICROCENTRUM LAURIFOLIUM Linnaeus.

Gryllus (Tettigonia) laurifolium LINNAEUS, Syst. Nat., 10th ed., I, 1758, p. 429.

One male at Durango, by E. J. Osler.

128. CONOCEPHALUS ENSIGER Harris.

Conocephalus ensiger HARRIS, Ins. Inj. Veg., 1841, p. 131.

Three males and two females, by E. J. Osler, marked "Colorado." One of the specimens, a male, is brown, all the others green.

129. CONOCEPHALUS TRIOPS Linnaeus.

Gryllus (Tettigonia) triops LINNAEUS, Syst. Nat., 10th ed., I, 1758, p. 430.

At Victoria, Texas, a mature male and an apparently half-grown nymph were taken on July 10 in grass near an old irrigating reservoir.

130. ORCHELIMUM HERBACEUM Serville.

Orchelimum herbaceum SERVILLE, Orth., 1839, p. 524.

Specimens of this species were taken in Texas, where it is not as common as the next species, with which it was found associated. Specimens were also taken in Colorado, by E. J. Osler, but are without locality or date.

131. ORCHELIMUM LONGIPENNE Scudder.

Orchelimum longipenne SCUDDER, Bost. Journ. Nat. Hist., VII, 1862, p. 453.

Quite common in the vicinity of lakes or water courses in southern Texas. The species differ from *herbaceum* in having a slightly longer ovipositor, and the form is not nearly so slender, especially in the males. The presence or absence of a dorsal stripe on the pronotum is not a very stable character for the separation of species in this genus, as there is considerable variation in this respect.

132. XIPHIDIUM FASCIATUM De Geer.

Xiphidium fasciatum DE GEER, Mem., III, 1773, p. 458, pl. XL, fig. 4.

A common and widely spread species. It often comes to light, sometimes in considerable numbers. Many specimens of both sexes were taken at Victoria, Texas, in June and July, and one male specimen was taken at Montevista, Colorado, on August 13.

133. XIPHIDIUM SALTANS Scudder.

Xiphidium saltans SCUDDER, Rept. U. S. Geol. Surv. Nebr., 1871, p. 249.

One male and six females at Fort Collins, August 10, in rank grass.

134. XIPHIDIUM STRICTUM Scudder.

Xiphidium strictum SCUDDER, Proc. Bost. Soc. Nat. Hist., XVII, 1875, p. 460.

Several females were taken near Victoria, Texas in June, 1902. They were in reeds near a swamp and both mature and immature specimens were taken. No males were seen.

135. XIPHIDIUM VICINUM Morse.

Xiphidium vicinum MORSE, Can. Ent., XXXIII, 1901, p. 203.

Three males and two females of this species were taken at Fort Collins on August 10, in rank grass. The females and one of the males are of the form called *productum* by Professor Morse.

136. CAPNOBATES FULIGINOSUS Thomas.

Locusta fuliginosa THOMAS, Ann. Rept. U. S. Geol. Surv. Terr., V, 1872, p. 443, pl. 1, fig. 9.

Two males at Bright Angel, Arizona on July 13, in the Colorado Canyon at an altitude of 3,000 feet. The spines on the outer inferior side of the fore femora of some specimens of this species are wholly wanting, their location being indicated by piceous spots.

137. ANABRUS COLORADUS Thomas.

Anabrus coloradus THOMAS, Ann. Rept. U. S. Geol. Surv. Terr., V, 1872, p. 440.

Six males, five females, Cumbres, August 14; Pikes Peak, July 21, and South Park, by Oslar.



At Cumbres the males were stridulating about 10 o'clock in the morning, and that led to their capture. They were in the grass and would never have been discovered but for their song. But even when once discovered their capture was not at all assured, for they blended in color with the grass so perfectly and were so active in eluding the grasp that many would escape when almost in the bottle.

138. *ANABRUS PURPURASCENS* Uhler.

Anabrus purpurascens UHLER, Proc. Ent. Soc. Philad., II, 1864, p. 550.

One pair, Fort Collins, August 10, on the prairie out half a mile from the foothills. The males were stridulating.

139. *EREMOPEDES BALLI* Caudell.

Eremopedes balli CAUDELL, Can. Ent., XXXIV, 1902, p. 100.

Six males, three females, Fort Collins, August 19; five males and three females, Williams, Arizona, from June 6 to July 30, and one male at Flagstaff, Arizona, on July 4. The specimens from Williams were found under bark, quite a surprising fact considering the habitat of the type specimens. In the more immature specimens the lateral lobes are persistently striped with a longitudinal blackish stripe which extends across the thorax and nearly to the end of the abdomen. On the thorax the stripe is sharply defined above and fades out gradually below. At Williams they appear to mature about a month earlier than at Fort Collins, the mature specimens being taken at the former place on July 1. The mature individuals from Arizona have the posterior femora marked externally by two black stripes, as mentioned under the next species.

140. *EREMOPEDES UNICOLOR* Scudder.

Eremopedes unicolor SCUDDER, Proc. Davenport Acad. Nat. Sci., VIII, 1899, p. 97.

One female from Hot Springs, Arizona June 12. This specimen is somewhat larger than the type and the pronotum is somewhat infuscated, the infuscation confined to a little more than the anterior half and not reaching to the inferior margins of the lateral lobes, though there is a dash of black next the margin just above the sinus. The posterior femora have two longitudinal black streaks, converging somewhat posteriorally. The measurements are as follows:

Length of thorax, 8.5 mm.; fore femora, 9 mm.; hind femora, 26 mm.; ovipositor, 19 mm.

141. *PLAGIOSTIRA ALBONOTATA* Scudder.

Plagiostira albonotata SCUDDER, Ann. Rept. Chief Eng., 1876, p. 501.

One pair of this handsome insect was taken at Williams, Arizona, on July 24. They were found on sagebrush.

142. *ATELOPLUS NOTATUS* Scudder.

Ateolophilus notatus SCUDDER, Proc. Davenport Acad. Nat. Sci., VIII, 1899, p. 98.

One mature female and three nymphs at Hot Springs, Arizona July 13 to 22. The smallest nymphs were collected on the earlier date. The mature specimen agrees with the type specimen in the collection of the National Museum except that there is no dorsal stripe present.

143. *CEUTHOPHILUS DEVIUS* Scudder.

Ceuthophilus devius SCUDDER, Proc. Amer. Acad. Arts Sci., XXX, 1894, pp. 30, 99-100.

A mature individual was taken at Durango by Oslar.

144. *CEUTHOPHILUS VALGUS* Scudder.

Ceuthophilus valgus SCUDDER, Proc. Amer. Acad. Arts Sci., XXX, 1894, pp. 27, 74-75.

Several specimens of both sexes in South Park, by Oslar.

145. *CEUTHOPHILUS VINCULATUS* Scudder.

Ceuthophilus vinculatus SCUDDER, Proc. Amer. Acad. Arts Sci., XXX, 1894, pp. 29, 91-92.

Specimens of what I take to be the young of this species were taken at the head of Chimney Gulch, above Golden, May 13. They were found in an old decaying stump.

146. *UDEOPSYLLA ROBUSTA* Haldeman.

Phalangopsis robusta HALDEMAN, Proc. Amer. Assoc. Adv. Sci., II, 1850, p. 346.

One female by E. J. Oslar, marked "Colorado."

Family GRYLLIDÆ.

147. *MYRMECOPHILA NEBRASCENSIS* Scudder.

Myrmecophila nebrascensis SCUDDER, Psyche, VIII, 1899, pp. 425, 427-428.

Several specimens of this species were taken at Williams, Arizona, on May 26 and June 3.

148. *CYCLOPTILUS SQUAMOSUS* Scudder.

Cycloptilus squamosus SCUDDER, Proc. Bost. Soc. Nat. Hist., XII, 1868, p. 142.

One female specimen on cotton at Victoria, Texas in late June.

149. *NEMOBIUS FASCIATUS* De Geer.

Gryllus fasciatus DE GEER, Mem., III, 1773, p. 522, pl. XLIII, fig. 5.

The macropterous form of this species occurred in large numbers at light in Victoria, Texas during the latter part of June. many hundreds being easily gathered in one evening from the various lights

scattered around through the town. But few brachypterous forms were seen at light. In Colorado but a single specimen of the macropterous form was seen, one by Oslar without date or locality. Brachypterous specimens of both sexes were taken at Fort Collins on August 10.

150. *NEMOBIUS UTAHENSIS* Scudder.

Nemobius utahensis SCUDDER, Journ. N. Y. Ent. Soc., IV, 1896, pp. 99, 103-104.

One male of what is evidently this species was taken at Sedalia June 15, and a freshly matured one at Montevista August 13.

151. *GRYLLUS ABBREVIATUS* Serville.

Gryllus abbreviatus SERVILLE, Orth., 1839, p. 336.

One male referable to this species was taken at Fort Collins August 11, and one at Sedalia June 15. The one from Fort Collins was freshly matured when found. An immature female was also taken at Fort Collins August 10.

152. *GRYLLUS PENNSYLVANICUS* Burmeister.

Gryllus pennsylvanicus BURMEISTER, Handb. Ent., II, 1838, p. 734.

The nymphs of what is evidently this species occurred in the cotton fields about Victoria, Texas in late June. Mature macropterous females were taken in woods under logs in early July. Brachypterous males and females were collected in Colorado at Golden, June 5; Denver, June 17; Platte Canyon, June 10, and Grand Junction, July 7. Mr. Oslar took a macropterous female at Canyon City. A pair of *Gryllus neglectus*, which may be considered a variety of this species, was taken at Canyon City in July by Oslar.

153. *GRYLLUS PERSONATUS* Uhler.

Gryllus personatus UHLER, Proc. Ent. Soc. Philad., II, 1864, p. 547.

Two males, three females, Grand Junction, by Oslar, all macropterous; one brachypterous male was taken at Winslow, Arizona, by Messrs. Schwarz and Barber.

154. *CECANTHUS QUADRIPUNCTATUS* Beutenmüller.

Cecanthus quadripunctatus BEUTENMÜLLER, Bull. Amer. Mus. Nat. Hist., VI, 1894, pp. 250-251, 271, fig. 3.

This species is quite common in the cotton fields of southern Texas. Specimens were also collected in Colorado at Fort Collins.

EXPLANATION OF PLATE LV.

Fig. 1. *Melanoplus coloradus*, new species, male.

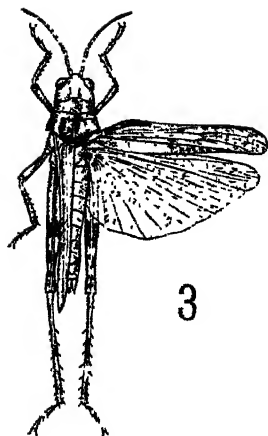
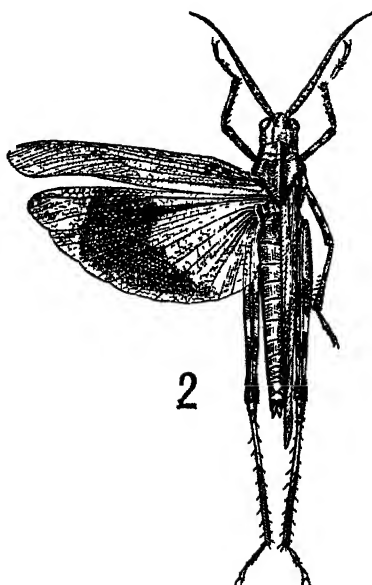
1a. *Melanoplus coloradus*, new species, male, end of abdomen.

2. *Psidium sulcifrons* var. *amplicornis*, new variety, female.

3. *Heliasius guanieri*, new species, female.

4. *Melanoplus latiferula*, new species, male.

4a. *Melanoplus latiferula*, new species, male, end of abdomen.



SOME AMERICAN ORTHOPTERA.

FOR EXPLANATION OF PLATE SEE PAGE 809.

SMITHSONIAN INSTITUTION.
UNITED STATES NATIONAL MUSEUM.

THE PHASMIDÆ. OR WALKINGSTICKS.
OF THE UNITED STATES.

BY

ANDREW NELSON CAUDELL,
of the Department of Agriculture

From the Proceedings of the United States National Museum, Vol. XXVI, pages 843-883
(with Plates LVI-LIX)

[No. 1335.]



WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1903.

THE PHASMIDÆ, OR WALKINGSTICKS, OF THE UNITED STATES.

By ANDREW NELSON CAUDELL,
Of the Department of Agriculture.

The Phasmidæ is one of the most interesting families of the order Orthoptera. It is poorly represented in the United States, and the species, being mimetic in nature, are not commonly met with. Our forms are all apterous and are confined in their distribution to the southern half of the country, with the exception of the species of the genus *Diapheromera*, one of which extends into Canada. The name "walkingstick" is commonly applied to these insects, and the common northern species, *Diapheromera femorata* Say, is the best known representative of the family. There is a popular belief extant in some parts of the country that these insects are very poisonous to stock when eaten by them. For this reason they have been called the "mule killer," though this name is more often applied to species of the family Mantidæ, which are said to be especially fatal to that useful animal. Among other popular names given to the walkingsticks are Devil's riding horse, Prairie alligator, Stick bug, Witch's horse, Devil's darn-ing needle, Scorpion, and Musk mare, the latter applied only. I believe, to the species of the genus *Anisomorpha*.

Nowhere do we find more striking instances of protective resemblance than those afforded by members of this family of curious insects. In the tropics, where these insects abound, such amazing adaptations as the wonderful Walkingleaf, *Phyllium scythe*, and other large, winged forms are found. In the United States the species are all wingless and mimic different kinds of twigs, especially so the more slender species of the genera *Diapheromera*, *Bacunculus*, and *Parabacillus*.

The Phasmidæ are insects of very deliberate motion, especially the females. They do not depend upon locomotion for protection from their enemies, but to their deceptive resemblance and, in some cases, to the power of emitting an offensive spray from special glands situated on the prothorax.

The species are exclusively herbivorous, none being known to take animal food. One exception is recorded where some partially starved leaf insects nibbled at the foliaceous expansions of their fellows, but not enough to injure them in any way. The female of one of our species has been recorded as eating off the head of the male while under the influence of sexual excitement, but the insect in question was most surely not a Phasmid but a Mantid, as this habit is not at all uncommon among some members of that family.

Regeneration of limbs is quite common among the Phasmidæ. Such limbs are much smaller and may always be distinguished by the absence of one tarsal joint, all regenerated limbs being tetramerous. According to Scudder, if the leg be removed nearer to the body than the trochantero-femoral articulation the limb will not be replaced.

The eggs of our species are dropped at random on the ground. Oviposition takes place in the fall of the year with our common northern species and the eggs lie over winter, and sometimes even through a second, before the nymphs issue. When the young walkingstick is in the egg, ready to emerge, the meso- and metathorax are not remarkably elongate, but before the little creature is fairly out of its narrow prison the thoracic segments assume their usual proportions. It is said to be a most curious sight by those who have observed this almost instantaneous development.

In my studies of these insects specimens of all of our species have been examined, except *Diapheromera mesillana* and *carolina* and *Pseudosermyla stramineus*. The material of the U. S. National Museum forms the basis of this paper. Specimens were loaned for study by the Colorado and Oklahoma experiment stations. For various kindnesses I wish to express my sincere thanks to Professors Scudder and Bruner and Mr. J. A. G. Rehn.

The family Phasmidæ may be defined as follows:

Body elongate, subcylindrical; abdomen with ten segments, the basal one usually coalesced to the posterior part of the metathorax, sometimes entirely invisible;* all of the legs equally ambulatory; wings wholly absent in the United States species, the location of the metathoracic pair, and sometimes the mesothoracic pair also, generally indicated by a stationary wing-like pad, bearing a gland, presumably a scent gland; tarsi five jointed, except in *Timema*, terminated by two claws, between which is a large arolium; ovipositor concealed by the subgenital plate; cerci inarticulate.

*In descriptive work the first abdominal segment is spoken of as the intermediary segment and the abdomen is considered as consisting of nine segments. Thus the basal or first abdominal segment as used in the following pages is really the true second one. Likewise the seventh, eighth, and ninth segments are, respectively, the eighth, ninth, and tenth ones. The generally inconspicuous nature of the true basal segment, which is sometimes even wholly invisible, makes this nomenclature seem advisable.

The species occurring in the United States fall into four subfamilies, separated as follows.

- a. Antennæ not more than one-half as long as the anterior femora.....CLITUMNINÆ.
- aa. Antennæ distinctly longer than the anterior femora.
 - b. Mesothorax never less than four times as long as the prothorax, generally more; tibiæ not furnished at the apex beneath with a sunken areola...BACUNCULINÆ.
 - bb. Mesothorax never more than three times as long as the prothorax, generally less; tibiæ furnished at apex beneath with a sunken areola.
 - c. Coxæ visible from above; tarsi five jointed.....ANISOMORPHINÆ.
 - cc. Coxæ invisible from above; tarsi three jointed.....TIMENINÆ.

Subfamily CLITUMNINÆ.

The insects representing this subfamily in the United States are very slender wingless walkingsticks with antennæ much shorter than the anterior femora in both sexes. The legs are slender and unarmed and the tibiæ are carinate beneath to the apex. The median segment is short and inconspicuous. Pronotum short as in *Bacunculinæ*. Cerci moderate, incurved in the male and straight in the female.

We have but one genus, which is here characterized as new.

PARABACILLUS, new genus.

Bacillus SCUDDER (not Latreille), Psyche, VI, 1893, p. 372.

Antennæ less than one-half as long as the anterior femora, composed of six or seven segments in the male and probably about that number in the female, but there, as also sometimes in the male, the segments are so closely connate as to be inseparable, except the first and second, which are very distinct.^a Head subpyriform, horizontal. Eyes small, round. Thorax with the pronotum about one-fifth as long as the mesonotum. Legs, smooth, unarmed, long and slender. Cerci as in *Diapheromera*.

Dr. Scudder considered the species of this genus to belong to the subfamily Bacillinæ and placed them in the old world genus *Bacillus*. But the absence of an areola at the apex of the tibiæ below refers them to the subfamily Clitumninæ. In many particulars the genus seems closely allied to the genus *Paraclitumnus* of Brunner von Wattenwye. We have a single species of the genus.

PARABACILLUS COLORADUS Scudder.

Plate LVII, fig. 1; Plate LVIII, fig. 1.

Bacillus coloradus SCUDDER, Psyche, VI, 1893, p. 372; Proc. Davenp. Acad. Sci., IX, 1902, p. 21, pl. 1, fig. 4.

Bacillus carinatus SCUDDER, Psyche, VI, 1893, p. 372.

^a *Bacillus hispanicus* Bolivar, belongs to this genus, but the antennæ are composed of sixteen distinct segments. The *Bacillus palmeri* of the author, recently described from Mexico, is also a member of this genus.

The following description is that of the author." which is quoted in full:

Bacillus coloradus Scudder (pl. 1, fig. 4), Baker's ranch, Beulah, Sapello Canyon, 8000' on *Monarda stricta* (Willmatte P. Cockerell); La Trementina (Alice Blake). The following description was taken from the first specimen, which is that figured:

Testaceous, more or less clouded with fuscous dorsally. Head striped feebly with fuscous, especially above and with five subequidistant delicate longitudinal carinae; whole thorax and abdomen similarly carinate, but otherwise smooth except for very minute rather sparsely scattered ferruginous granules between the dorsal and subdorsal carinae; second joint of antennae small and globular, the remainder consisting of a hardly articulate, slightly depressed, lanceolate, bluntly pointed mass.

Length of body, 48 mm.; antennae, 4.5 mm.; mesothorax, 10.5 mm.; metathorax, 8.5 mm.; abdomen, 25 mm.; hind femora, 12 mm.; width of metathorax in middle, 1.5 mm.

The above description is from a female specimen. The males are more slender, with longer antennae and legs.

From a study of a series of specimens, both male and female, from Nebraska, Colorado, New Mexico, Arizona, and California I conclude that there is but one species. They show a certain amount of variation in color and size, but afford no specific characters. The antennae of a mature pair from California measure 5 mm. in the female and 7 mm. in the male. One male from Arizona has antennae measuring 12 mm. in length. The color varies from almost wholly infuscated to a light brown. One female from California has an extreme length of very nearly 70 mm. But there are all stages of gradation between these extremes of color and size and no characters present themselves to warrant the recognition of more than the one species.

Subfamily BACUNCULINÆ.

The members of this subfamily are long, slender, stick-like insects with the mesothorax at least five times as long as the prothorax; antennae, except in *Sermyle*, more than twice as long as the anterior femora; tibiae without a sunken areola at apex beneath.

The slender body at once distinguishes this subfamily from the others of our fauna except Clitumninae. The long antennae, however, readily separates it from that group. We have four genera of Bacunculinae occurring in the United States. The following table will serve to separate them:

- a. Head subquadrate or subcylindrical, usually distinctly longer than broad, attached obliquely or horizontally. (Plate LVII, fig. 4.) Male cerci subequal throughout or apically trifid.
- b. Middle femora of the male not much swollen, not thicker than the posterior ones; posterior femora unarmed in both sexes.
- c. Male cerci apically trifid, head carinate or longitudinally rugose between the eyes; antennae rarely twice as long as the anterior femora.

Pseudosermyle, new genus.

- d. Male cerci simple; head smooth; antennae more than twice as long as the anterior femora *Bacunculus* Burmeister.

- bb. Middle femora of the male much swollen, distinctly thicker than the posterior ones; posterior femora armed beneath on the median line near the apex with a single spine, in the male very prominent, in the female often very small and sometimes wholly absent *Diapheromera* Gray.
- aa. Head ovate, short, scarcely longer than broad, attached vertically (Plate LVII, fig. 2^a); male cerci spatulate, much broader apically than at the base (Plate LVII, fig. 2^b) *Megaphasma*, new genus.

PSEUDOSERMYLE, new genus.

Head subcylindrical, distinctly longer than broad, horizontally attached to the thorax and in front between and behind the eyes either carinate or longitudinally rugose; antennæ no more, or but little more, than twice as long as the anterior femora; legs unarmed; basal segment of the abdomen generally subquadrate in the female, twice or more than twice as long in the male. Cerci of the female simple, of the male apically trifid.

This genus, of which *P. banksii* may be considered the type, is most nearly allied to *Sermyle* Stål, but differs in the character of the male cerci, which are simple in the latter genus.^a The head of the only species of *Sermyle* examined, a female from Guatemala, is very much shorter in proportion than found in the species of *Pseudosermyle*. It is also somewhat closely allied to *Bacunculus*, and the most stable character for its separation from that genus, exclusive of the male genital characters, seems to be the dorsally carinate or rugose head.

The males of *Pseudosermyle strigata* and *arbuscula* are unknown and it may be that these species will eventually prove to belong to *Sermyle*, but until the male sex is made known it is deemed safest to include them here.

Pseudosermyle is represented in the United States by five species, which may be separated by the following tables. The first table is based wholly upon the characters of the female:

- a. Body multicarinate or longitudinally rugose.
- b. Cerci short, no more than three times as long as the greatest width; supraanal plate subtruncate or obtusangulate at the apex.
- c. Femora short and stout (Plate LVIII, fig. 4), the posterior ones about nine mm. in length *arbuscula* Rehn.
- cc. Femora longer and more slender (Plate LVIII, fig. 3^a), the posterior ones about twenty mm. in length *truncata*, new species.
- bb. Cerci long, six times as long as the greatest width; supraanal plate acutely angulate at the apex *strigata* Scudder.
- aa. Body smooth *stramineus* Scudder.

Pseudosermyle banksii does not appear in the above table for the reason that the female is unknown. The species of which the males

^aThe male of *Sermyle mexicanus* Saussure, the type of *Sermyle*, is not positively known, but a male specimen that Stål thought quite surely belonged to that genus had simple cerci, as in *Bacunculus*. Besides this, other Mexican species referred to this genus have simple cerci.

are known may be separated by the following table, which is based wholly upon the characters of that sex:

- a. Seventh abdominal segment distinctly inflated on the posterior half.
 b. Long and slender, length about 60 mm.....*banksii*, new species.
 bb. Shorter and less slender, length about 40 mm.....*truncata*, new species.
 aa. Seventh abdominal segment not inflated.....*stramineus* Scudder.

PSEUDOSERMYLE ARBUSCULA Rehn.

Sermyle arbuscula REHN, Can. Ent., XXXIV, 1902, p. 273.

The following description of this species is taken in full from the author's article referred to above:

Type, female, San Diego, California, May 7, 1901.

This species does not seem to be very closely related to any of the previously known species of the genus. From *azteca* Saussure, it is differentiated by having the femora carinate and striate; from *sericusurii* Stål, by the nonampliate sixth abdominal segment; and from *strigata* Scudder, by the more robust limbs and the less strongly striate body. With *mexicana* and *linearis* Saussure, no affinity exists.

General form slender, the thoracic portion rather robust. Head rather elongate, bearing two central longitudinal rugæ, which become obscure caudad, the whole surface of the head rather tuberculate, the tubercles being longitudinally disposed; eyes subspherical, slightly exerted; antennæ longer than cephalic femora; the proximal segment large and broad, with the distal section contracted, this segment over twice as large in bulk as the next. Pronotum, mesonotum, and metanotum tuberculate, the tubercles resolving into longitudinal series, this being more apparent on the metanotum, the mesonotum and metanotum being centrally carinate; pronotum rather narrow, not quite equaling the head in length; mesonotum long (with pronotum equaling the cephalic femora), the lateral margins slightly tuberculate; metanotum very considerable shorter than the mesonotum, comparatively robust, expanding in the caudal portion. Abdomen rather slender, multistrigate, none of the segments exhibiting any special ampliation; ventral surface between the sixth and seventh segments exhibiting a pair of flattened longitudinal processes. Cephalic femora heavy, with the proximal diastema (found in many representatives of this family) rather well marked, the remaining section of the segment being inflated and with three prominent angles; tibiæ as long as the femora, quadrate slightly tapering; first tarsal joint about as long as the succeeding ones. Intermediate femora short, triangular in section, equaling the metanotum (and median segment) in length; tibiæ depressed, about equaling the femora in length; first tarsal joint considerably less than the succeeding joints in length. Caudal femora short, reaching the middle of the third abdominal segment, roughly triangular in section; tibiæ rather longer, reaching to the apex of the first segment. General color, reddish brown, washed with ashy gray on the cephalic limbs.

Measurements.

	mm.
Length of body.....	54
Length of pronotum.....	3
Length of mesonotum.....	12
Length of metanotum (with median segment).....	8.7
Length of abdomen.....	28
Length of cephalic femora.....	14
Length of intermediate femora.....	7.5
Length of caudal femora.....	8.7

The supranal plate of this species is shown at Plate LVII, fig. 3, and for this drawing I am indebted to the describer. This species seems remarkable for the extreme brevity of the posterior femora.

PSEUDOSERMYLE TRUNCATA, new species.

Plate LVIII, figs. 3, 3*a*, 3*b*.

Color grayish brown. Head above with two pairs of prominent carinæ, the carinæ of each pair subparallel at base, flaring somewhat just beyond the middle and then rapidly converging slightly beyond the eyes by the incurving of the outer carina. Just anterior of the termination of these carinæ is an elevated, posteriorly bifurcated tubercle and between the two pairs of carinæ is a minute mesial carina extending halfway along the length of the head. Antennæ basally thicker than in *strigata*. Pronotum above with a slight mesial longitudinal incision and with a shallow transverse furrow just behind the middle which does not extend to the borders, which are strongly carinate; disk with two subdorsal carinæ, less distinct behind the transverse furrow, and with a couple of indistinct, less elevated carinæ between them and the border of the pronotum; mesonotum, and metanotum, together with the intermediary segment and the abdomen carinated as in *strigata*, but the whole body is much less covered with tubercles, the abdomen being almost entirely destitute of them and the thorax supplied more sparingly than in that species. Legs much more robust than in *strigata* and showing traces of fuscous bands more noticeable on the middle femora. Supranal plate broader than in *strigata* and subtruncate apically. Cerci short and comparatively broad, about three times as long as broad.

Length of body, 73 mm.; mesothorax, 16.5 mm.; metathorax, 10.5 mm.; middle femora, 15 mm.; hind femora, 20 mm.

One female, Dos Cabezos, Arizona, June, 1891.

Type.—No. 6613, U.S.N.M.

One immature female specimen, in poor condition, from Bright Angel, Arizona, is referred to this species. It has the posterior femora extending only to the middle of the fourth abdominal segment and the basal five segments of the abdomen are furnished posteriorly above with two prominently elevated tubercles, one on each side.

The U. S. National Museum also contains one female and six male specimens from Los Angeles County, California, that evidently belong here. The female is apparently immature, probably being in the last stage. It is 54 mm. long, and the posterior femora are 16 mm. in length. The males differ from the females in being entirely smooth except for the two main carinæ on the anterior part of the head between the eyes, and in being smaller and quite slender. The cerci project obliquely downward, are trifid apically, the center branch forming the terminus of the main body of the cerci, and engage each

other at their tips. Plate LVIII, fig. 3, represents the cerci of the male of this species. In immature specimens the cerci are simple, being merely flattened and slightly concave.

The measurements of these male specimens are as follows: Length of body, 40 mm.; antennæ, 27 mm.; mesothorax, 9.5 mm.; metathorax, including the intermediary segment, 7.5 mm.; fore femora, 13.5 mm.; middle femora, 12 mm.; hind femora, 15 mm.; width of middle of mesothorax, 1.5 mm.

These Californian specimens are much lighter colored than those from Arizona, and may represent a new species, but without additional material it is not deemed advisable to describe them as such.

The type specimen was received at the Department of Agriculture on June 17, 1891. The following note regarding it is quoted from the notebook of the Division of Entomology:

Rec. from F. W. Anderson, Asst. Ed. Am. Agr., N. Y., 1 specimen, female, of a *Diapheromera*, new to the collection, received from Los Cabezos, Arizona, with the statement that it is more deadly to stock than loco-weed if eaten by them. It is called in that section "Campo mucho."

This species, while in general resembling *strigata*, is really very distinct. The broader supraanal plate with its subtruncate apex, short broad cerci, larger legs and smoother body, will at once distinguish it from that species.

PSEUDOSERMYLE STRIGATA Scudder.

Plate LVI, fig. 3; Plate LVIII, fig. 8.

Sermyle strigata SCUDDER, Cat. Orth. U. S., 1900, pp. 14, 94-95, pl. 1, fig. 3.

The author's description is as follows:

Whole body dull ashy gray. Head furnished above with four longitudinal rows of small tubercles. Whole thorax mesially carinate and also furnished above on either side with a pair of carina, all the carinae equidistant and furnished, as well as the intermediate spaces, with small sparsely scattered tubercles. Abdomen and intermediary segment similarly marked, but with an additional pair of subdorsal carinae and with fewer and much more obscure granulations, mostly confined to the carinae. Hind femora reaching to the end of the fifth abdominal segment. Abdomen nowhere expanded.

Length of body, 72 mm.; antennæ, 30 mm.; mesothorax, 18.5 mm.; metathorax, 10.5 mm.; abdomen, 35.5 mm.; hind femora, 22.5 mm.; width of middle of mesothorax, 3 mm.

Three males. Texas, Boll, Lincecum.

This species appears to fall near *S. azteca* Sauss., but differs by the carinate thorax with its dull coloring.

The cerci, as shown in the table of species, are very long, being six times longer than broad.

PSEUDOSERMYLE STRAMINEUS Scudder.

Plate LVIII, fig. 2.

Bacunculus stramineus SCUDDER, Proc. Davenport Acad. Sc., IX, 1902, p. 20, pl. I, fig. 1.

Described by the author as follows:

Bacunculus stramineus Scudder, sp. nov. (pl. I, fig. 1). Body very slender, flavo-testaceous, the sides of the thorax, the undersurface of the metathorax, and most of the undersurface of the middle femora white or hoary, at least in the male, the tibiae more or less tinged with green in the female; the terminal abdominal segments are more or less hoary (male) or green (female). Head a little longer than the pronotum, somewhat tumid in the female, laterally striped with white in the male, in the latter with a pair of longitudinal rugæ following behind the inner margin of the antennal scrobes; antennæ pale green (female) or testaceous, becoming apically infuscated (male), very slender and shorter than the body. Body smooth, the thorax with a feeble median carina. Seventh abdominal segment of male nearly as long as the eighth and ninth together, the ninth slightly longer than the eighth, the seventh segment not inflated, bearing beneath a bulbous body not reaching the extremity of the eighth segment with a cap which a little surpasses it; ninth segment cylindrical, equal, truncate, bearing a pair of cerci, straight, rather stout, but compressed, equal and apically very briefly and bluntly bifid plates, nearly as long as the segment.

Length of body, male, 50 mm., female, 42 mm.; antennæ, male, 22 mm., female, 26 mm.; head, male, 2.5 mm., female, 2.5 mm.; thorax, male, 23 mm., female, 18.5 mm.; mesothorax, male, 12.5 mm., female, 9 mm.; abdomen, male, 23.5 mm., female, 22 mm.; fore femora, male, 14 mm., female, 10.5 mm.; middle femora, male, 11.5 mm., female, 8 mm.; hind femora, male, 14 mm., female, 10.5 mm.; width of metathorax in middle, male, 1 mm., female, 1.5 mm. 1 male, 1 female. Between Mesilla Park and Little Mountain, July 1. (A. P. Morse.)

The female is probably not quite mature.

PSEUDOSERMYLE BANKSII, new species.

Body very slender, testaceous, paler below. Head pale, slightly longer than the pronotum and distinctly swollen anteriorly, the sides marked with a longitudinal black stripe and with the usual longitudinal carinæ on top between and behind the eyes. Body smooth, with scarcely a trace of a median carina; mesothorax much longer than the metathorax. Seventh segment of the abdomen slightly shorter than the eighth and ninth together and considerably swollen on the posterior half, and here furnished with the usual ventral appendage, which is slightly longer than the eighth segment; eighth and ninth segments subequal in length, the latter the larger and equal. The cerci are as long as the last abdominal segment, moderately slender, slightly compressed, curving very slightly downward and inward, and are apically trifid, the center branch curving inward quite abruptly and forming the terminus of the main body of the cerci.

Length of body, 64 mm.; antennæ, 50 mm.; mesothorax, 16.5 mm.; metathorax, including the intermediary segment, 12 mm.; fore femora,

25 mm.; middle femora, 22 mm.; hind femora, 25 mm.; width at the middle of the mesothorax, 1.25 mm.

One male from Brazos County, Texas, collected in September by Mr. Nathan Banks, in whose honor the species is named. Also a male from Buna, Jasper County, Texas, on November 15, 1902, by Dr. A. D. Hopkins. The latter specimen was taken on pine.

Type.—No. 6616, U.S.N.M.

This insect may prove to be the male of *Sermyle strigata* Scudder, but more material is needed before it can be proven. The very slender form, however, seems to militate against this.

BACUNCULUS Burmeister.

Bacunculus BURMEISTER, Handb. Ent., II, 1838, p. 566.

Burmeister established *Bacunculus* as a subgenus of *Bacteria*. As represented in the United States, the genus is defined as follows:

Very closely allied to *Diapheromera*. Head smooth in both sexes, subcylindrical, anteriorly swollen, elongate, more than twice as long as broad, and horizontally attached to the thorax. Antennæ much more than twice as long as the anterior femora. Prothorax about one-sixth as long as the mesothorax; mesothorax slightly longer than metathorax. Legs of male unarmed, slender, filiform; middle femora of male not at all swollen as they are in *Diapheromera*; legs of female usually unarmed, but the middle and posterior femora are sometimes armed below on the median line next the apex with a distinct, though usually minute, spine. Body of male more slender than in *Diapheromera* and the cerci of similar shape and relative proportion as in that genus.

The unswollen middle femora of the males make it easy to distinguish this genus from *Diapheromera*, but from female specimens alone it is more difficult. The more elongate and anteriorly swollen head together with the more generally unarmed legs will usually serve, however, to distinguish the females with considerable certainty.

In the United States we have a single species.

BACUNCULUS TENUESCENS Scudder.

Plate LVI, figs. 1, 2.

Bacunculus tenuescens SCUDDER, Cat. Orth. U. S., app., 1899, p. 95.

This species is figured on Plate I, figs. 1 and 2 of the above work, and described in the following words:

Body exceedingly slender, flavous beneath, brown (male) or green (female) above, becoming infuscated on the lower portion of the sides, forming a postocular stripe. Head greatly elongated, much longer than the pronotum; antennæ much shorter than the body. Entire body quite smooth with a very delicate mesial carination. Seventh and eighth abdominal segments of male subequal in length, slightly longer than the fifth and about half as long as the sixth, the seventh segment scarcely

inflated, bearing beneath a deflexed subspatulate convex plate, reaching the tip of the eighth segment and no broader than it; ninth segment cylindrical, equal, truncate, bearing a pair of decurved and incurved, cylindrical but slightly clavate, blunt tipped cerci, about as long as the segment.

Length of body, male, 64.5 mm., female, 53 mm.; antennæ, male, 41 mm., female, 35 mm.; head, male, 3.25 mm., female, 3.5 mm.; thorax, male, 31.5 mm., female, 25 mm.; mesothorax, male, 16 mm., female, 13 mm.; abdomen, male, 30 mm., female, 25 mm.; fore femora, male, 18 mm., female, 15.5 mm.; middle femora, male, 14.5 mm.; female, 13.5 mm.; hind femora, male, 20 mm., female, 16 mm.; width of mesothorax at middle, male, female, 1 mm.

One male, one female. Cedar Keys, Fla., June 6; Capron, Florida.

The tip of the abdomen of the female is lost.

The female from which the above description was made is evidently immature, as the measurements do not at all agree with those of mature individuals in the collection of the U. S. National Museum. The following notes are made from a mature female collected by Hubbard and Schwarz at Cedar Keys, Florida, in the month of June:

Color uniformly light greenish-brown, probably green in life. Ninth abdominal segment slightly longer than the seventh. Supraanal plate subtriangular, mesially keeled. Cerci long and slender, about as long as the last abdominal segment. Extreme length of body from front of head to tip of cerci, 85 mm., head 4.5 mm., mesothorax 19 mm., metathorax 14.5 mm., fore femora 19 mm., middle femora 16.5 mm., hind femora 20.5 mm., cerci 4 mm.; width of mesothorax at middle 2 mm.

A female specimen from Biscayne, Florida, from the Riley collection, which is referred to this species, is apparently much above the ordinary size, giving the following measurements: Extreme length of body 110 mm., head 5.5 mm., mesothorax 24 mm., metathorax 19.5 mm., fore femora 27.5 mm., middle femora 21 mm., hind femora 26 mm., cerci 4 mm. This specimen is but little thicker than moderate-sized individuals and shows no peculiarities indicative of a new species.

The brown color of the males of this species varies from light to quite dark, and the legs, probably also the body in some specimens, are greenish-brown.

DIAPHEROMERA Gray.

Diapheromera GRAY, Syn. Phasm., 1835, p. 18.

This genus has the following characters:

Head smooth in both sexes, subquadrate or subcylindrical, usually less than twice as long as broad and obliquely attached to the thorax; antennæ much more than twice as long as the anterior femora; prothorax usually less than one-fourth as long as the mesothorax; meso- and metathorax subequal in length. Body linear, especially in the male; basal segment of abdomen oblong, in male twice as long as broad. Middle femora much swollen in the male, distinctly thicker than the hind ones, those of the female scarcely swollen and not distinctly larger than the hind ones. Posterior femora armed beneath on median line near the apex with a single spine, in the male large and distinct, in the

female sometimes large and distinct but usually much smaller than in the male and sometimes minute or even wholly absent. Cerci of male cylindrical, longer than the last abdominal segment and, except in *D. mesillana*, strongly incurved.

Our common northern walkingstick belongs to this genus, the species of which are distributed more widely over our country than those of any other of our genera. None of the species have been found west of the Rocky Mountains. Five species occur in the United States. They may be separated by the following table, which is for the greater part taken from a paper on this genus by Dr. Scudder:^a

- a. Male cerci strongly incurved.
 - b. Ninth abdominal segment of male subequal, scarcely larger at apex than at base, the seventh segment much longer than the eighth; male cerci with a basal tooth.
 - c. Inner ventro lateral carina of the posterior femora with minute serrations; meso- and metathorax unicolorous.
 - d. Male cerci with a blunt tooth at inner inferior base (Plate LVIII, fig. 6); female cerci relatively stout, about half as long as the last dorsal segment. *femorata* Say.
 - dd. Male cerci with a sharp thorn at inner inferior base (Plate LVIII, fig. 5); female cerci relatively slender, almost or quite as long as the last dorsal segment. *relic* Walsh.
 - cc. Inner ventro-lateral carina of the posterior femora smooth; meso- and metathorax longitudinally marked with black beneath. *arizonensis*, new species.
 - bb. Ninth abdominal segment of male apically inflated, and here nearly half as broad again as at base, the seventh and eighth segments of subequal length; male cerci without a basal tooth. *carolina* Scudder.
- aa. Male cerci rigidly straight. *mesillana* Scudder.

DIAPHEROMERA FEMORATA Say.

Plate LVII, fig. 4; Plate LVIII, fig. 6.

Spectrum femoratum SAY, Exp. Long., II, 1824, p. 297; Amer. Ent., III, 1828, p. 37, pl. XXVII.—LEIDY, Proc. Acad. Nat. Sci. Philad., III, 1846, pp. 80-84.

Diapheromera femorata HARRIS, Treat. Ins. Inj. Veg., 1840, p. 119.—SCUDDER, Psyche, IX, 1901, p. 188.

Phasma (Bacteria) femorata HAAN, Bijdr. kenn. Orth., 1842, pp. 101, 134.

Bacunculus femoratus UHLER, Harris, Treat. Ins. Inj. Veg., 3d ed., 1862, p. 146.

Diapheromera sayi GRAY, Syn. Phasm., 1835, p. 18.

Bacteria sayi CHARPENTER, Orth. descr., 1841-1845, pl. IV.

Bacteria (Bacunculus) sayi BURMEISTER, Handb. Ent., II, 1838, p. 566.

Bacunculus sayi THOMAS, Trans. Ill. St. Agric. Soc., V, 1865, p. 441.

Bacteria linearis GOSSE, Lett. Alab., 1859, p. 275.

Color fuscous or green, the males more often exhibiting the latter color. Mature individuals, especially the females, are almost always fuscous during the autumn months. The middle femora of the dark colored males are distinctly banded with lighter color.

Head smooth in both sexes, subquadrate, scarcely elongate, obliquely

^a Psyche, IX, 1901, pp. 187-189.

attached to the thorax; eyes round, slightly more prominent in the male than in the female. Antennæ long and slender, about as long as the body; prothorax short, about one-fifth as long as the mesothorax, the dorsal cruciform impression distinct, especially the transverse incision; meso- and metathorax subequal in length, without median carina. Legs of male long and slender, except the middle femora, which are much swollen and distinctly thicker than the others; of the female, shorter in proportion, and the middle femora are not swollen, no thicker than the others. Fore legs unarmed, undulate and smaller at the base; hind and middle femora of the male armed beneath on the median line near the apex with a large, prominent spine; of female, similarly armed, but the spine is much smaller, often quite minute. Abdomen smooth; intermediary segment visible only from above and firmly united to the metathorax; basal segment elongate, nearly or quite twice as long as broad in the female and three times as long as broad in the male; seventh segment in the male distinctly longer than the ninth and three times as long as the eighth. Cerci of male somewhat longer than the terminal segment of the abdomen, cylindrical, oval at apex, bluntly tubercled interiorly at base, clothed with microscopic stiff hairs and strongly curved horizontally inwards, usually crossing each other at about the middle; female cerci straight, stout, acuminate, less than half as long as the terminal segment of the abdomen, and partially concealed from above by the exposed tip of the triangular supraanal plate, which, as well as the cerci, is sparsely covered with very short hairs of microscopic size.

Length of body, male, 72 mm., female, 70 mm.; mesothorax, male, 17 mm., female, 16 mm.; metathorax, male, 16 mm., female, 13.5 mm.; middle femora, male, 15.5 mm., female, 11.5 mm.; hind femora, male, 19.5 mm., female, 15 mm.; hind tibia, male, 25 mm., female, 16 mm.

The above description was drawn up from a male and female collected in copulation at Rosslyn, Virginia, on September 12, 1900. The males are quite uniform in size, but the females are quite variable, the one from which the above measurements were taken being a small specimen. A large female from Massachusetts before me gives the following measurements: Length of body, 92 mm.; mesothorax, 19 mm.; metathorax, 17 mm.; middle femora, 14.5 mm.; hind femora, 18.5 mm.; hind tibia, 20 mm.

This species is our most common phasmid and occurs throughout the northern part of the country from the Rocky Mountains eastward. It is said to also occur as far south as Mexico, but is more rare in the South, being quite generally replaced there by the next species, *veliei*. Many of the southern records pertain to allied species mistaken for *femorata*.

These insects mate in the autumn and pairs are often seen in the act

of copulation. The female drops the eggs at random in the wood-, where they lie till the following spring before hatching. Eggs deposited on November 9 and kept indoors gave forth the young during the last week of the following March. Some eggs are slow in giving forth the nymphs and so the insect may be found in various stages of development all through the season. Some of the eggs lie through even the second winter before hatching. The young are said to pass through but two stages in the course of growth, which averages less than two months. The newly hatched nymphs are of a uniform pale yellowish-green color and measure about 5 mm. in length, ones reared at the insectary of the Division of Entomology giving the following measurements: Length of body, 8 mm., hind femora, 3.5 mm. The young are said to live on low herbage and drop to the ground when disturbed. There is but one generation annually.

This is the only one of our phasmids that is of economic importance. It has been recorded as occurring in injurious numbers on forest trees. In such cases burning over the ground in winter to kill the eggs is recommended.

DIAPHEROMERA VELIEI Walsh.

Plate LVIII, fig. 5.

Diapheromera veliei WALSH, Proc. Ent. Soc. Philad., III, 1864, pp. 409-10.—
SCUDDER, Psyche, IX, 1901, p. 189.

This species may be defined as follows:

Of the same size and form as *D. femorata*, and also agreeing with it in being dimorphic in color, both brown and green forms occurring. It differs from that species in the following particulars: Head slightly more elongate; middle femora of male not usually banded with gray; seventh abdominal segment of the male no longer than the ninth, while in *femorata* it is one-fourth longer. Male cerci with a sharp spine or tooth at the base on the inner side instead of a blunt tubercle; female cerci nearly or quite as long as the apical segment of the abdomen instead of less than half as long, and they are usually more slender than in *femorata*. In general, the color of the dark form of *veliei* seems to be somewhat lighter than that of the corresponding form of *femorata*, but in this respect both species are variable.

This species is more southern in its distribution than *femorata*. It occurs east of the Rocky Mountains from Nebraska to Maryland, south to Georgia and Texas. It occurs also in Mexico. It was described from Nebraska, and Scudder reports it from a number of States within the region specified above. I have seen specimens from Virginia, Kansas, Oklahoma, Texas, and Colorado. Some of the females from Oklahoma have the spine beneath the posterior and intermediate femora entirely aborted, causing them to be separable from

the females of *Bacunculus* only with great difficulty. The shape of the head and the association of the males with the females, however, made the identification quite certain.

DIAPHEROMERA ARIZONENSIS, new species.

Slenderer than *D. femorata*, uniformly light yellowish brown, with the meso- and metathorax longitudinally marked beneath with shiny black. Antennæ nearly as long as the body and concolorous with it. Thorax smooth, with a very slight median carina; mesothorax slightly longer than the metathorax; seventh segment of the abdomen distinctly longer than the ninth, somewhat constricted on the anterior third; ninth segment with the posterior margin concave, exposing the tip of the triangular supraanal plate. Cerci shaped as in *femorata* and *veliei*, with the basal tooth intermediate between those species. Legs long and slender, the middle femora related; less swollen than in allied species.

Length of body, 76 mm.; antennæ, about 65 mm.; mesothorax, 18 mm.; metathorax, 16.5 mm.; middle femora, 18 mm.; hind femora, 22.5 mm.

One male, Hot Springs, Arizona, June 28, 1901. Collected by Messrs. Schwarz and Barber.

Type.—No. 6612, U.S.N.M.

This species is closely allied to *femorata* and *veliei*, but can be distinguished from them by the characters given in the table and by the more slender form. The elongate seventh abdominal segment will readily separate it from *veliei*. It is quite a characteristic-looking species, though the differences that separate it from its allies are difficult to define.

DIAPHEROMERA CAROLINA Scudder.

Diapheromera carolina SCUDDER, Psyche, IX, 1901, p. 188.

The following is the description as given by the author:

Stouter than *D. femorata*, testaceo-castaneous, glistening, the thorax with a rather broad median bronze-fuscous stripe, not reaching the median segment, and interrupted at the posterior end of the mesonotum, the fore legs greenish, the antennæ testaceous; thorax with excessively fine transverse striation. Mesothorax and metathorax (including median segment) of similar length. Seventh and eighth abdominal segments of subequal length, each faintly enlarging from base, the ninth a little shorter, apically inflated and subglobose, nearly half as broad again at apex as at base, the cerci much as in *D. femorata*, but stouter, more compressed, and without basal tooth.

Length of body, 67 mm.; head, 3 mm.; mesothorax, 13.5 mm.; fore femora, 20.5 mm.; hind femora, 19.5 mm.

One male. North Carolina. (Morrison.)

DIAPHEROMERA MESILLANA Scudder.

Diapheromera mesillana SCUDDER, Psyche, IX, 1901, p. 189.

The original description is here given in full.

Slenderer than *D. femorata*, uniform greenish flavous, the antennæ infuscated beyond the basal third, the thorax smooth, with an obscure median carina; subapical inferior spine of middle and hind femora rather slight. Mesothorax and metathorax (including median segment) of equal length. Seventh and ninth abdominal segments subequal in length and distinctly longer than the eighth, all equal in width and nowhere enlarged, the ninth rather feebly and angularly emarginate, exposing a small, transverse, apically arcuate, supraanal plate; cerci about as long as the ninth abdominal segment, rigidly straight, directed backward and not at all downward, slender tapering, blunt tipped, externally convex, and internally concave.

Length of body, 55 mm.; head, 3 mm.; antennæ, circa 37 mm.; mesothorax, 12.5 mm.; fore femora, 14.5 mm.; middle femora, 11 mm.; hind femora, 13.5 mm.

Two males. Between Mesilla and Las Cruces, New Mexico, June 30. (A. P. Morse.)

MEGAPHASMA, new genus.

Head smooth, rounded, subvertical; antennæ more than twice as long as the anterior femora; prothorax one-fifth as long as the mesothorax and transversely incised; meso- and metathorax subequal in length and with a distinct, though slight, median carina. Middle and hind femora swollen in both sexes, the middle ones somewhat larger than the posterior ones in the male, and both the middle and posterior pairs in both sexes armed beneath on the median line next the apex with a prominent spine and sometimes, at least in the female, with a row of equally large ones extending along the entire length of the femora below.

This genus is erected for that large Southern walkingstick described by Stål as *Diapheromera dentricus*. This insect exhibits characters that are certainly of generic value. The rounded, subvertical head, broad, spatulate cerci and unusually large size will readily separate it from all other of our genera. *Diapheromeru* is the most nearly allied genus, but the characters given in the table will at once separate it from that genus of much smaller insects.

In the United States we have a single species.

MEGAPHASMA DENTRICUS Stål.

Plate LVII, fig. 2, 2a, 2b.

Diapheromera dentricus STÅL, Rec. Orth., III, 1875, p. 76.—SCUDDER, Psyche, IX, 1901, p. 187; Harpers Mag., LXXXVIII, 1894, p. 456, fig. 1.

This species was originally described from Opelousas, Louisiana. The following description is made from specimens, male and female, in the U. S. National Museum collection:

Yellowish brown or fuscous. Head rounded, subvertically attached

to the thorax. Antennæ multiarticulate,^a more than twice as long as the anterior femora. Cruciform impression on the pronotum distinct, meso- and metathorax subequal in length and furnished above with a scarcely perceptible delicate median carina. Ninth abdominal segment slightly longer than the seventh. Legs stout, anterior ones unarmed and but half as thick as the others; posterior and middle tibiæ deeply denticulate below on the median carina, which is considerably elevated and terminated at the apex in a blunt spine, as is also the posterior ventro-lateral carinæ. The posterior and intermediate femora are large and regularly trapezoidal in form, each border below denticulate and spined on the median line with small apinules, except the terminal one, which is very large in the male. In the female all the spines are often large, but not so large as the terminal one of the male; the femora are broadest on the lower side and slightly swollen toward the base. The male femora are somewhat more rounded than those of the female. Posterior femora extending to the apex of the third abdominal segment in the female and almost to the middle of the fourth in the male; margins above coxal cavities slightly expanded and dentate. Cerci stout, in female less than one-half as long as the last abdominal segment; in male expanded apically, somewhat spatulate and directed strongly downward.

The original description, which was made from the female sex alone, gives the following measurements: Length of body 123 mm.; thorax 53 mm.; mesothorax 24 mm.; metathorax 24 mm.; abdomen 70 mm.; fore femora 27 mm.; middle femora 20 mm.; posterior femora 23 mm.; width of middle of mesothorax 5 mm.

Often the general color is reddish brown, legs lighter. A specimen in the U. S. National Museum collection has the middle and hind femora and the posterior two-thirds of the prothorax green, variegated with light gray and brown; on the femora the gray is grouped together in the form of broad, illy defined bands. Other specimens have the anterior portion of the prothorax and mesothorax, both above and below, greenish black.

This insect has been recorded from Louisiana, Texas, New Mexico, and, with doubt, from Alabama. One female specimen in the U. S. National Museum is from East Joplin, Missouri, the most northern locality yet recorded for this species.

This is the largest walkingstick that occurs in the United States, a female before me measuring 145 mm., which is 5 mm. less than one in the collection of the Academy of Natural Sciences of Philadelphia. This species suggests tropical forms more than anything else in our

^aThe antennal segments of a male specimen from Texas were counted and were found to number just seventy-eight. The antennæ of the specimen figured is drawn nearly twice too thick, except basally.

fauna, and the large size commands attention wherever seen. Mr. Mitchell, of Victoria, Texas, informs me that they are not uncommon in the wooded bottoms in that vicinity, where they occur on grape vines.

Subfamily ANISOMORPHINÆ.

In this subfamily the antennæ are more than twice as long as the anterior femora. Tibiæ furnished with a sunken areola below next the apex; coxæ visible from above; tarsi distinctly pentamerous. Mesothorax not more than three times as long as the prothorax. Intermediary segment invisible.

We have a single genus of this subfamily in the United States.

ANISOMORPHA Gray.

Anisomorpha GRAY, Syn. Phasm., 1835, p. 18.

This genus, as represented in the United States, has the following characters:

Head not more than one and one-half as long as broad, horizontally attached to the thorax. Body broad and stout, especially in the female; prothorax furnished with distinct odoriferous glands; meso- and meta-thorax subequal in length. Legs stout and thick, unequal, the middle pair the shortest; abdominal segments subquadrate or transverse, especially in the female, the seventh and ninth subequal in length, intermediary segment invisible. Cerci short, rounded, similar in both sexes.

We have two closely allied species, one occurring more commonly in the extreme Southern States and the other ranging farther north. Their differences are comparative and may be tabulated as follows:

- a. Female, color generally yellowish brown with conspicuous broad black dorsal and lateral stripes. Head noticeably longer than broad; body more elongate, seven to nine times as long as broad. Male, color and head as in female. Body still more elongate, about twelve times as long as broad, averaging about 45 mm. in length *buprestoides* Stoll.
- aa. Female, color uniformly ferruginous of various shades or inconspicuously striped with very narrow dusky dorsal and lateral stripes. Head less noticeably longer than broad. Body proportionately shorter and broader, six to six and one-half times longer than broad. Male, color same as female. Head and proportions about the same as in *buprestoides* but smaller, averaging no more than 35 mm *ferruginea* Palisot.

ANISOMORPHA BUPRESTOIDES Stoll.

Plate LIX, fig. 1.

- Phasma buprestoides* STOLL, Repr. Spectr., 1787-1813, p. 68, pl. xxiii, fig. 87.
- Anisomorpha buprestoides* GRAY, Syn. Phasm., 1835, p. 19.—SCUDDER, Can. Ent., XXVII, 1895, p. 30.
- Phasma (Anisomorpha) buprestoides* HAAN, Bijdr. Kenn. Orth., 1842, p. 101.
- Spectrum divitatum* SAY, Amer. Ent., III, 1828, pl. xxxviii.
- Spectrum vittata* JÄGER, Life N. Amer. Ins., 1854, p. 123.

The following description of this common Southern walkingstick is made from a series of both sexes in the collection of the United States National Museum.

Color varying shades of yellowish brown, often almost fuscous, with conspicuous broad, black stripes extending from the front of the head to the tip of the abdomen, one dorsal and one on each side. These stripes, in dark-colored individuals, are often more or less confused, but in light-colored specimens they are very conspicuous and well defined. Some specimens, apparently killed soon after transformation, are paler in color and with the stripes narrow and indistinct. Legs short and stout, unequal, the middle pair the shortest, in male more slender than in the female, dark colored, except in light-colored individuals, where they are colored the same as the body; the tibiae and femora of each pair of legs are subequal in length. Head noticeably longer than broad, horizontally attached to the thorax and subquadrate in shape, somewhat swollen anteriorly. Antennae about three times as long as the anterior femora, the fourth segment the shortest. Prothorax mesially incised and transversely sulcate in the middle, about twice as long as broad, usually more than one-third as long as the mesothorax, furnished above on each well-elevated border in front with a prominent gland, opening laterally from which is ejected a pungent spray when the insect is excited. Meso- and metathorax subequal in length, the former usually slightly the longer and on the disk sometimes furnished, especially toward the sides, with several granules, often quite acute; there is no median carina. Abdomen smooth, without carina, segments, especially the basal ones of the female, subquadrate or transverse, in the male usually somewhat longer than broad, intermediary segment invisible. In the female the seventh segment beneath forms a large scoop-shaped process, at the base of which are situated the genital organs. Cerci short, in the female no more than one-half as long as the last abdominal segment, in the male almost as long as the apical segment, straight and subcylindrical in both sexes, projecting subhorizontally backward in the female and subperpendicularly downward in the male. The male usually has the tip of the abdomen curved under.

Measurements made from a mated pair from Key West, Florida, are as follows: Length of body, male 45 mm., female 61 mm.; head, male 3.5 mm., female 6 mm.; antennae, female 40 mm.; prothorax, male 3.5 mm., female 6 mm.; mesothorax, male 7 mm., female 12 mm.; metathorax, male 6 mm., female 10 mm.; fore femora, male 9.5 mm., female 13 mm.; middle femora, male 7 mm., female 10.5 mm.; hind femora, male 9.5 mm., female 14 mm.; width of head, male 2.5 mm., female 4 mm.

This species, which is sometimes called the musk mare, seems to occur most commonly in the extreme Southern States. The U. S.

National Museum contains over twenty specimens, all from Florida, except some without labels, which are probably from Mississippi. It has been recorded from various localities in the southeastern part of the United States, but the more northern records doubtlessly belong to the next species. Several young specimens referable to this species are uniformly brownish gray in color, but otherwise resemble the adults.

ANISOMORPHA FERRUGINEA Palisot de Beauvois.

Plate LIX, fig. 2.

Phasma ferruginea PALISOT DE BEAUVOIS, Ins. Afr. Amer., 1805-1821, p. 167, pl. xiv, figs. 6, 7.

Anisomorpha ferruginea GRAY, Syn. Phasm., 1835, p. 18.

Phasma (Anisomorpha) ferruginea HAAN, Bijdr. Kenn. Orth., 1842, p. 101.

This species is very closely allied to the preceding one. The color is in general lighter than in *buprestoides* and usually uniform, and not conspicuously marked by black stripes as in that species, sometimes with narrow stripes, more often noticeable in the males. The head is usually less noticeably longer than broad, and the body is proportionately shorter and broader as tabulated above. The males average less in size and the habitat seems to extend farther north than that of *buprestoides*. The measurements from a pair from Tallulah, Georgia, are as follows:

Length of head, male 3 mm., female 5.5 mm.; body, male 31 mm., female 50 mm.; fore femora, male 8 mm., female 10 mm.; middle femora, male 5.5 mm., female 8.5 mm.; hind femora, male 8 mm., female 11 mm.; prothorax, male 2.5 mm., female 5 mm.; mesothorax, male 5 mm., female 9.5 mm.; metathorax, male 4 mm., female 8.5 mm.; width of head, male 2 mm., female 4.5 mm.

This species appears to extend farther north than *buprestoides*, but it also occurs in Florida. The specimens in the collection of the United States National Museum are from Florida, Louisiana, Kentucky, and Pennsylvania.

This species, as well as the preceding one, is said to be able to throw a colored fluid to a considerable distance from the well-developed scent glands, situated on the thorax.

TIMEMINÆ, new subfamily.

This subfamily presents the following characters:

Antennæ longer than the anterior femora; tibiæ furnished beneath at the apex with a sunken areola; coxæ invisible from above; tarsi three jointed. Intermediary segment as distinct as the rest of the abdominal segments, freely articulated to the thorax and not at all connate with it as in all other of our groups.

This well-defined subfamily is proposed for the genus *Timema* of

Scudder. The structure of the insects here included is different from all other of our Phasmidæ, as is shown by the legs being attached beneath the body in such a manner as to conceal the coxæ from above. The three-jointed tarsi are also peculiar to this subfamily. The three-jointed tarsi are obviously the result of a union of the first three segments of the normal pentamerous phasmid tarsus. This is indicated by the lower surface of the first segment showing obscure segmentation where the original segments have united.

We have but one genus of this interesting subfamily in the United States.

TIMEMA Scudder.

Timema SCUDDER, Can. Ent., XXVI, 1895, p. 30.

The characters limiting this genus are:

General form short and broad, not linear, head subquadrate, no longer than broad, as broad as the thorax. Antennæ much longer than the anterior femora, basal segment very large, three times as long as broad, enlarged apically. Prothorax quadrate, not narrowed anteriorly, no shorter than the metathorax and without distinct odoriferous glands; meso- and metathorax subequal in length. Legs short and stout; cerci of male forcipulate, irregular in shape and curving inwards, of female stout, vertically flattened and straight, in both sexes longer than the last abdominal segment.

We have a single species.

TIMEMA CALIFORNICA Scudder, new species.

Plate LVII, fig. 5; Plate LVIII, figs. 7, 7a.

This species, the type of the genus, has never been described. Dr. Scudder has very kindly furnished the following description, which is here published for the first time:

Head large, thorax depressed, abdomen depressed cylindrical, expanding somewhat posteriorly, the whole body smooth, glistening a little, nearly uniform luteo-testaceous with a faint greenish tinge, the abdomen slightly lighter in tint than the thorax, the latter striped longitudinally and narrowly with brownish fuscous, most distinctly in a submarginal stripe, in which are fuscous impressed puncta. Antennæ about as long as head and thorax together. All the legs short, the hind femora about as long as the first three abdominal segments. Last abdominal segment of male somewhat expanded and tumid, the hind margin sinuato-truncate, the cerci about as the last segment, asymmetrical, tortuous, abruptly incurved, basally depressed, apically tapering to a point.

Length of body, male 14.25 mm.; female 22.5 mm.; antennæ, male 5.25 mm.; female 7 mm.; mesonotum, male 1.5 mm.; female 2.5 mm.; hind femora, male 3.25 mm.; female 4.5 mm. One male, one female, Santa Cruz Mountains, California. (L. Bruner.)

The U. S. National Museum contains three typical specimens of this species, two males and one female, from Santa Cruz Mountains, Cali-

fornia, collected by Albert Keobele. The antennæ of the males are broken, but those of the female are intact and measure 1½ mm. in length and are 22 jointed. It would therefore appear that the antennæ of Dr. Scudder's specimens, at least those of the female, were broken.

The trochanters of these insects are large and distinct, more so than in any other of our Phasmidæ. The head is marked by a narrow post-ocular stripe, which extends more or less distinctly across the entire length of the pronotum.

Besides these specimens from the Santa Cruz Mountains, the U. S. National Museum contains a male and a female from Los Angeles County, California, that may represent a new species, but their condition is too poor to warrant their description as such without additional and better preserved material. They differ from the typical specimens in being proportionately shorter, head more flattened vertically, without the postoculate black line, and, together with the pronotum in the male, rugose above. The female cerci are more slender, and the meso- and metathorax of both sexes seem less developed than in the specimens from Santa Cruz Mountains. The male cerci also differ in being more foliaceous. Plate LVIII, fig. 7^a, shows the male cerci of the specimen from Los Angeles County, and Plate LVIII, fig. 7, the same of the Santa Cruz Mountain specimens.

This species apparently represents a step in the transition from the Phasmidæ to the Forficulidæ. The forcipal cerci of the males, ventrally attached legs, short, broad head, and especially the short, stout legs with the three jointed tarsi, indicate a relation to the ear-wigs. As Phasמידs these creatures are certainly anomalies, and at a casual glance are not always readily recognized, having, in one instance at least, been mistaken for a species of Perlid larvæ.

NOTE.

Since this paper has been made up into pages, Mr. E. A. Schwarz collected a specimen of Phasmidæ representing a species new to our fauna. It was taken at Key West, Florida, on April 6, and, except for the discordant factor of the median segment being slightly shorter than the metathorax, seems to fall quite naturally into the Bacterid genus *Haplopus* of Gray. As the specimen is an immature female, any attempt at specific determination would be unsatisfactory. It may eventually prove to be the *Haplopus cubensis* of Saussure, but it does not seem to agree very well with the description of that species.

EXPLANATION OF PLATES.

PLATE LVI.

(After Scudder.)

- Fig. 1. *Bacunculus tennesseus* Scudder, male. -
2. *Bacunculus tennesseus* Scudder, male, side view of the tip of the abdomen.
3. *Pseudosermyle strigatus* Scudder, female.

PLATE LVII.

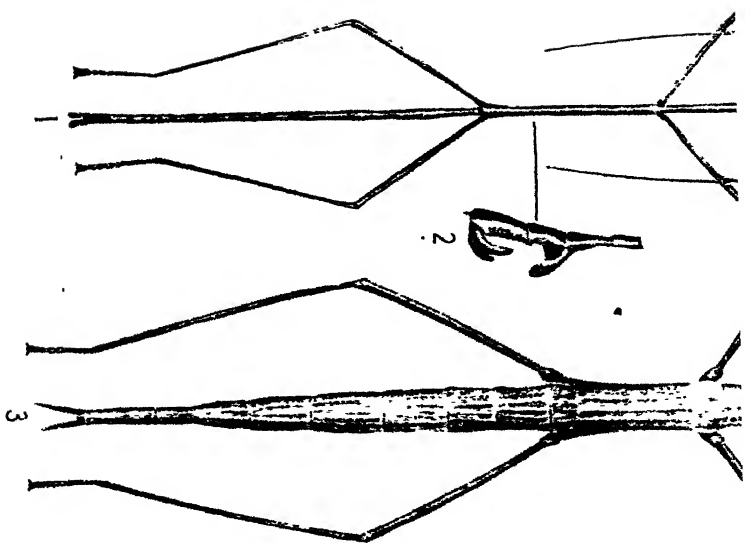
- Fig. 1. *Parabacillus coloradus* Scudder, male.
2. *Megaphasma dentricus* Stål, male.
2a. *Megaphasma dentricus* Stål, male, side view of head and pronotum.
2b. *Megaphasma dentricus* Stål, male, side view of the tip of the abdomen.
3. *Pseudosermyle arbuscula* Rehn, female, end of the abdomen.
4. *Diapheromera femorata* Say, male, side view of head and pronotum.
5. *Timema californica* Scudder, female.

PLATE LVIII.

- Fig. 1. *Parabacillus coloradus* Scudder, female (after Scudder).
2. *Pseudosermyle stramineus* Scudder, male (after Scudder).
3. *Pseudosermyle truncata*, new species, male, side view of the tip of the abdomen.
3a. *Pseudosermyle truncata*, new species, female, right middle leg.
3b. *Pseudosermyle truncata*, new species, female, tip of abdomen.
4. *Pseudosermyle arbuscula* Rehn, female, right middle leg.
5. *Diapheromera veliei* Walsh, male, end of abdomen.
6. *Diapheromera femorata* Say, male, end of abdomen.
7. *Timema californica* Scudder, male, end of abdomen.
7a. *Timema californica* Scudder, variety, male, end of abdomen.
8. *Pseudosermyle strigata* Scudder, female, end of abdomen.

PLATE LIX.

- Fig. 1. *Anisomorpha buprestoides* Stål, female.
2. *Anisomorpha ferruginea* Palisot de Beauvois, female.



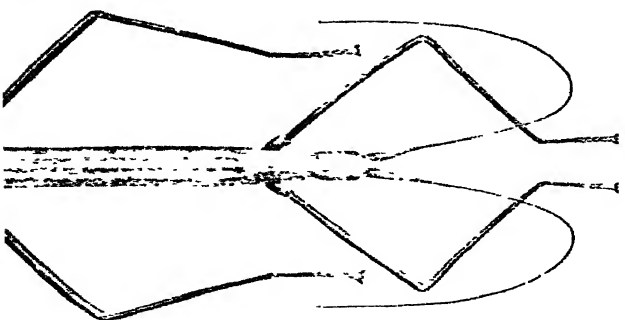
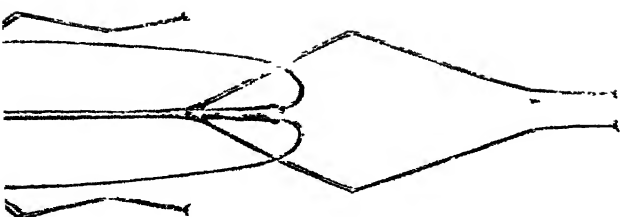
2

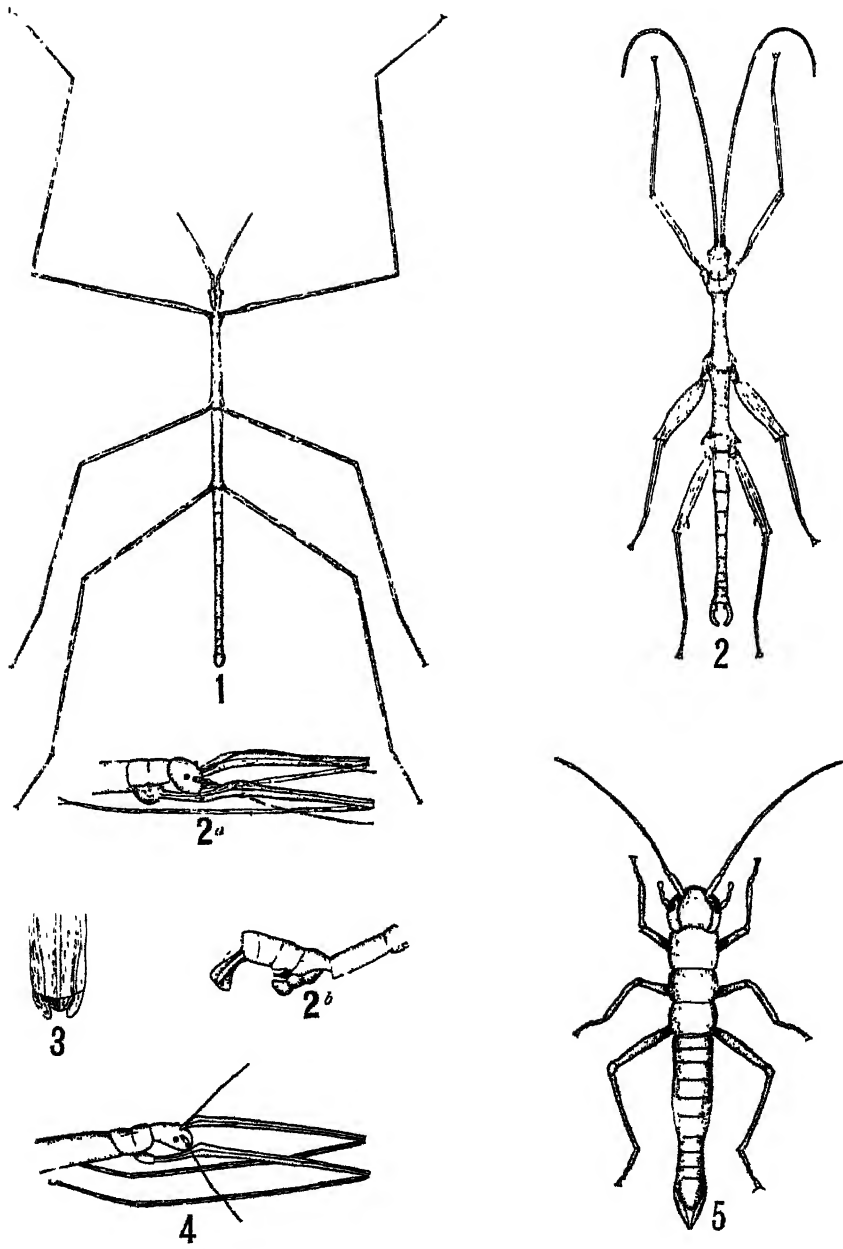
WALKINGSTICKS OF THE UNITED STATES.
FOR EXPLANATION OF PLATE SEE PAGE 894.



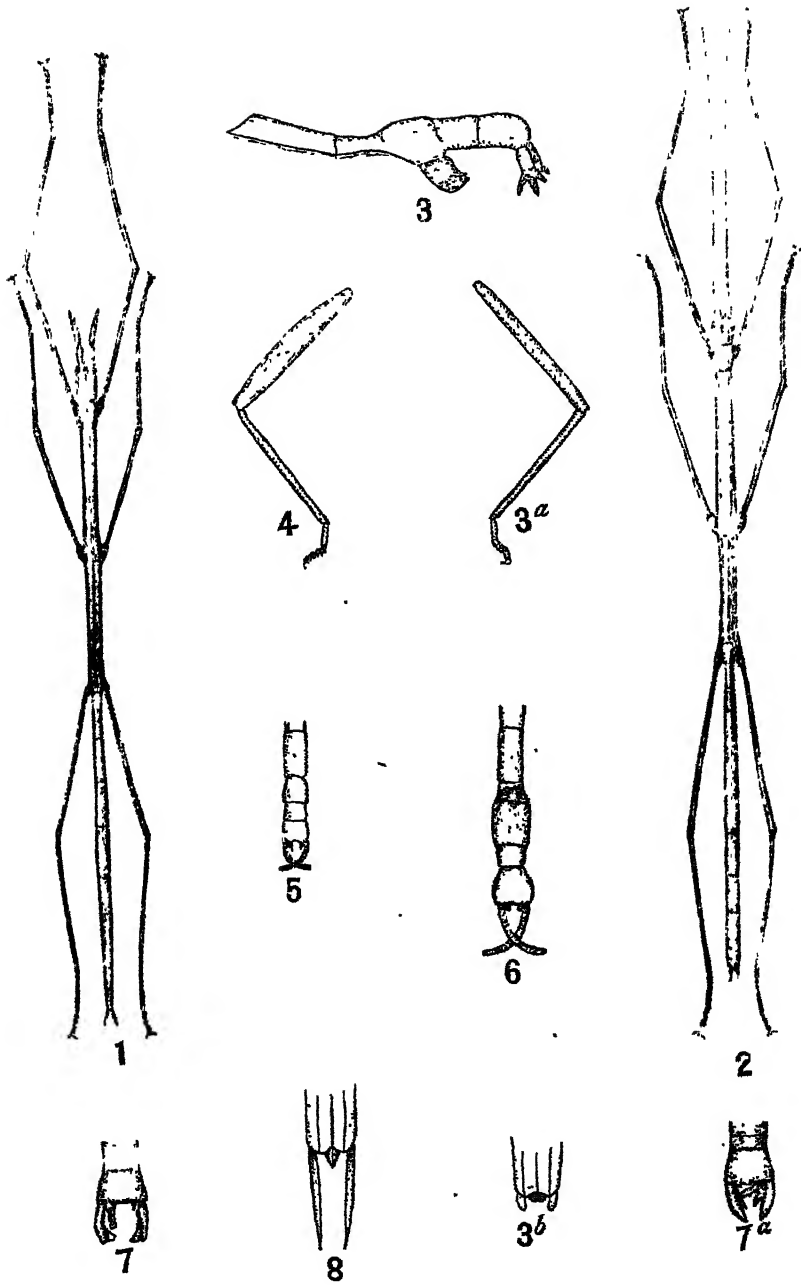
U. S. NATIONAL MUSEUM

PROCEEDINGS, VOL. XXVI PL. LVI



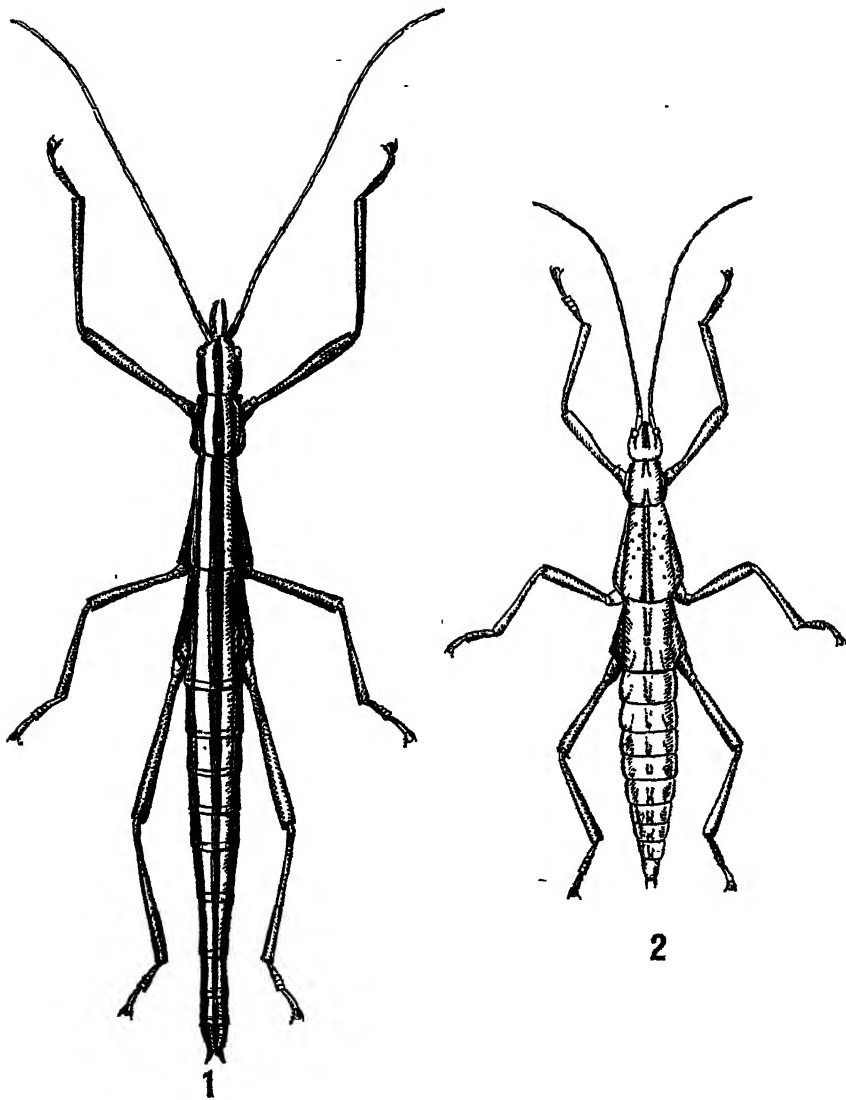


WALKINGSTICKS OF THE UNITED STATES.
FOR EXPLANATION OF PLATE SEE PAGE 884.



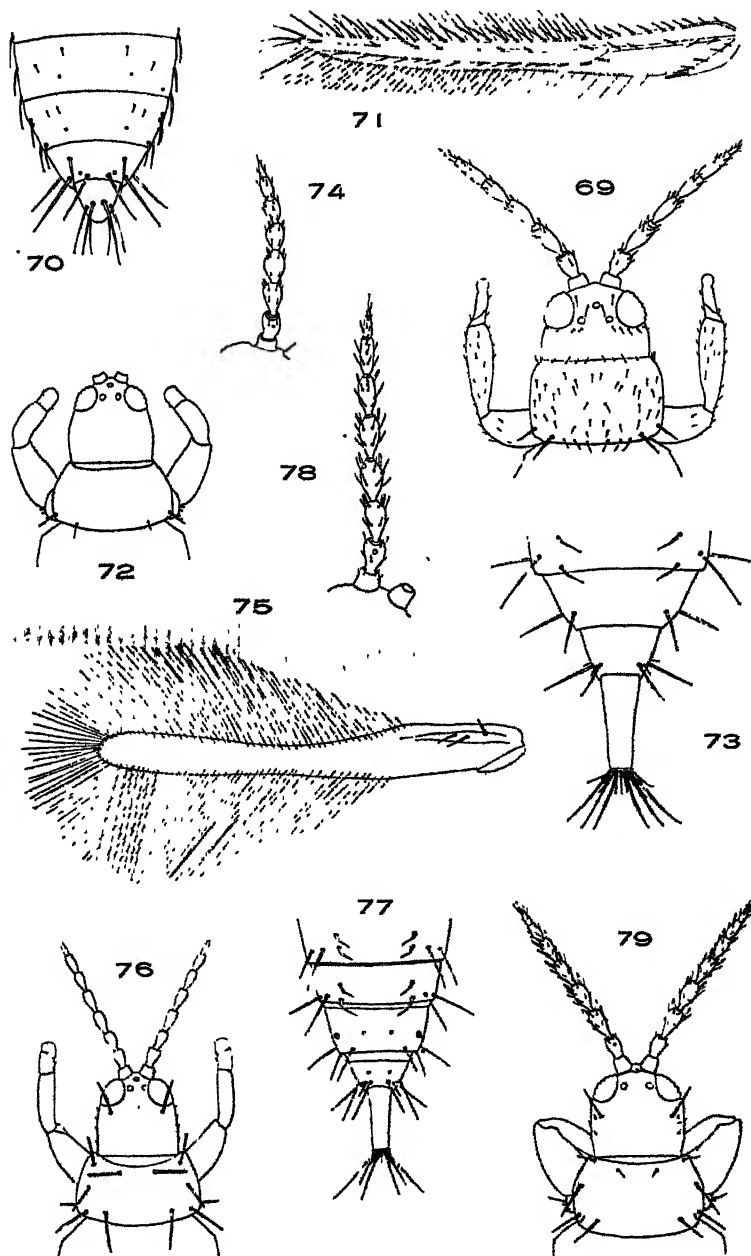
WALKINGSTICKS OF THE UNITED STATES.

FOR EXPLANATION OF PLATE SEE PAGE 885.



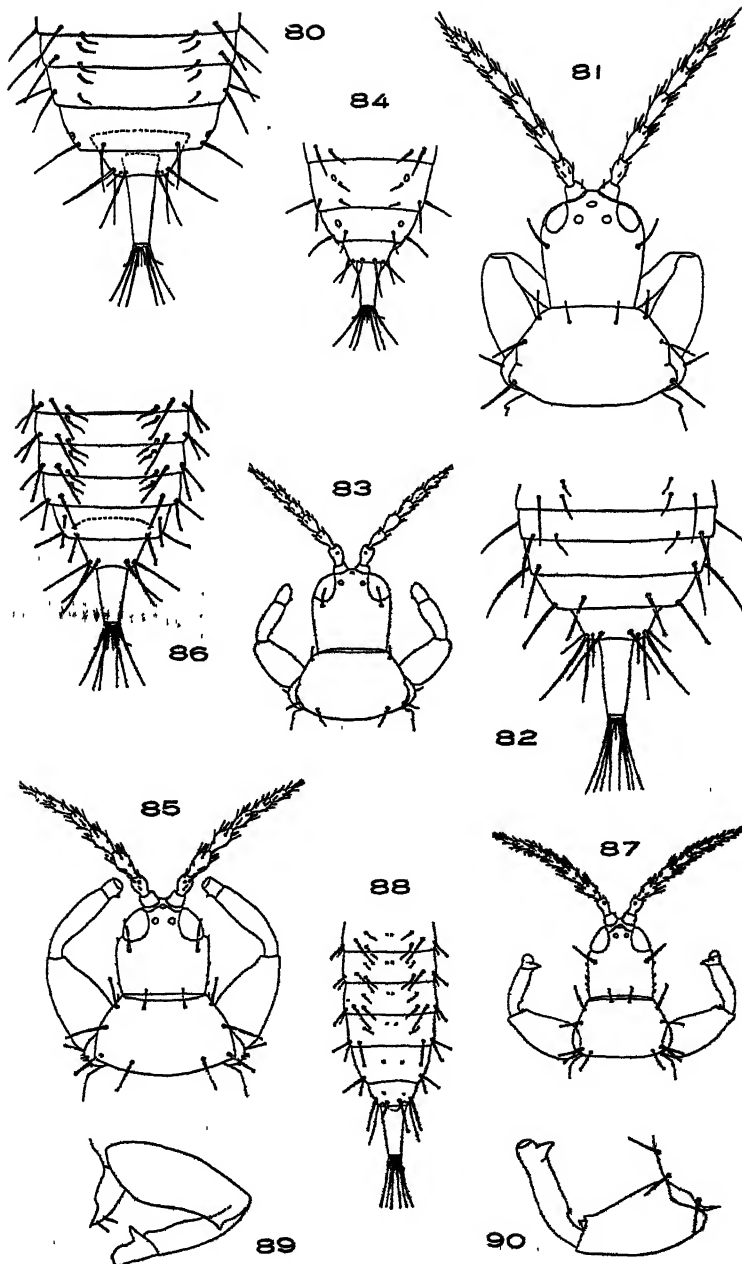
WALKINGSTICKS OF THE UNITED STATES.

FOR EXPLANATION OF PLATE SEE PAGE 885.

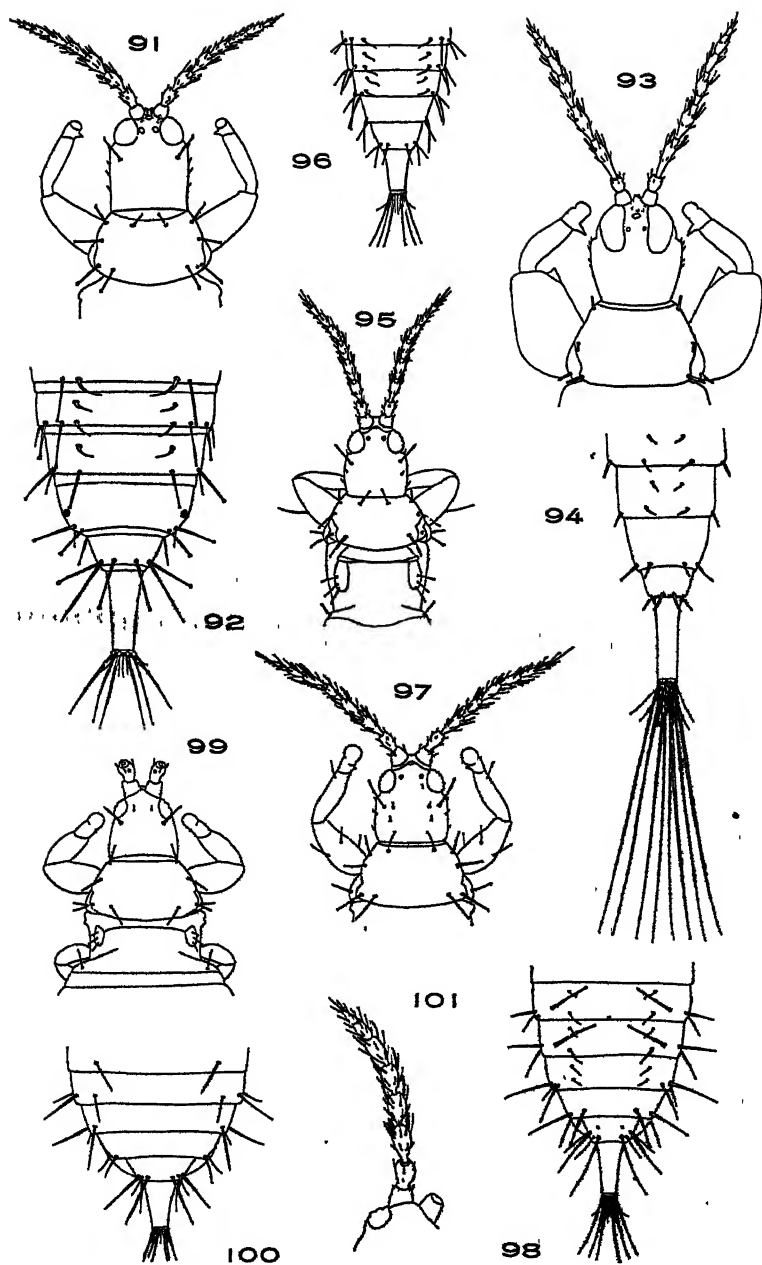


NORTH AMERICAN THYSANOPTERA.

FOR EXPLANATION OF PLATE SEE PAGE 239.

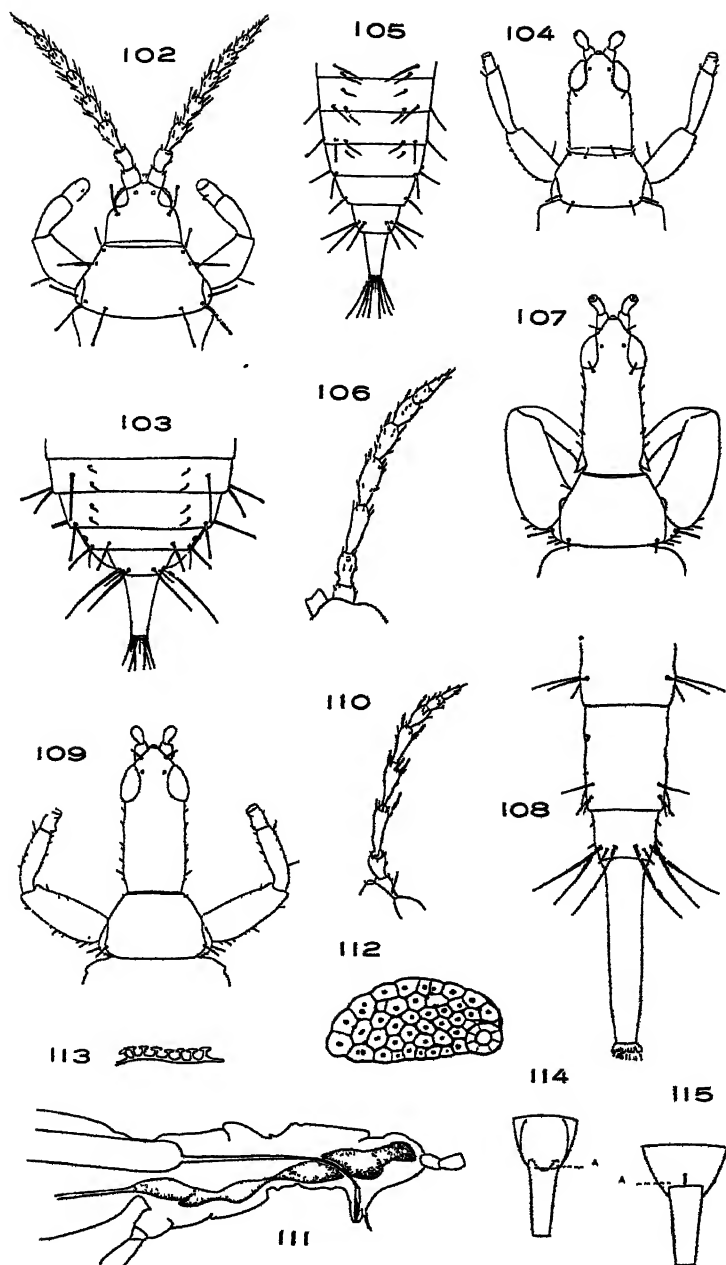


NORTH AMERICAN THYSANOPTERA.
FOR EXPLANATION OF PLATE SEE PAGE 240.



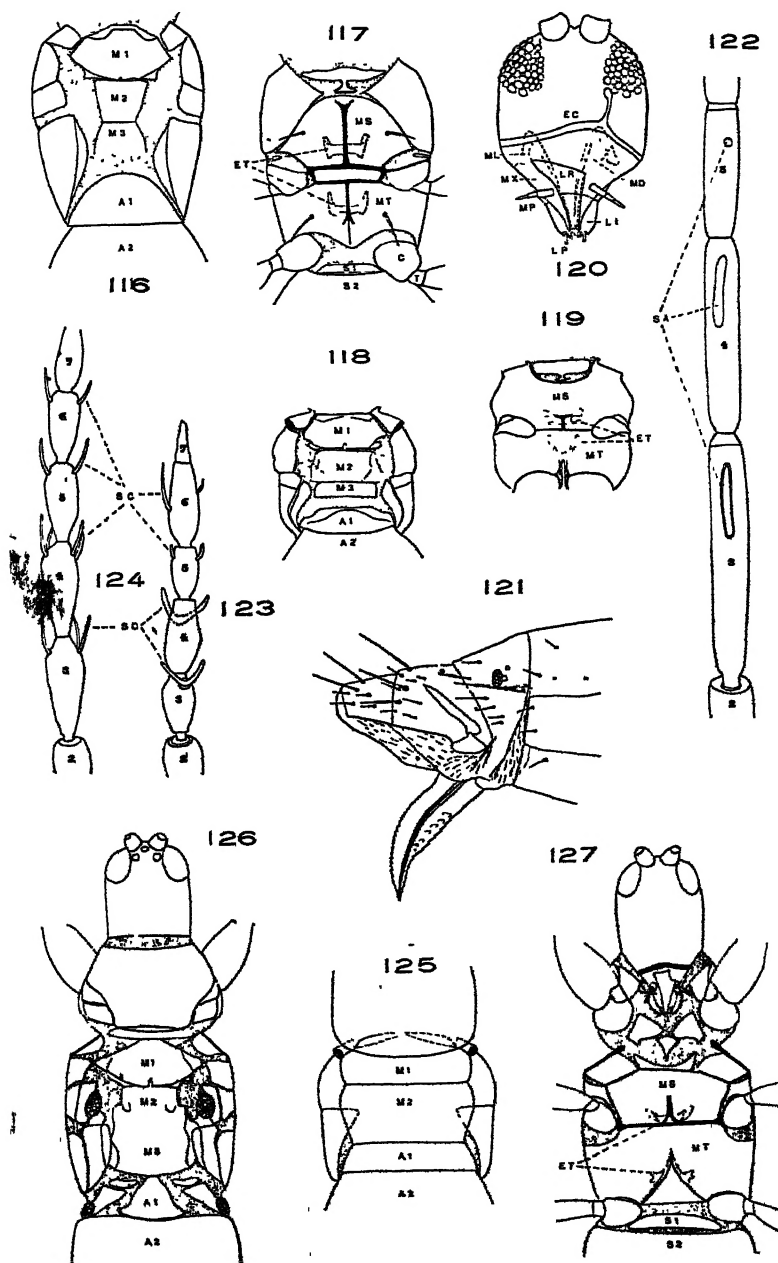
NORTH AMERICAN THYSANOPTERA.

FOR EXPLANATION OF PLATE SEE PAGE 240.



NORTH AMERICAN THYSANOPTERA.

FOR EXPLANATION OF PLATE SEE PAGE 241.



NORTH AMERICAN THYSANOPTERA.

FOR EXPLANATION OF PLATE SEE PAGES 241, 242.

[illegible]